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THE EFFECT OF THE KYOTO PROTOCOL ON AMERICAN SMALL BUSINESS

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BEFORE THE

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HOUSE OF REPRESENTATIVES

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THE EFFECT OF THE KYOTO PROTOCOL ON AMERICAN SMALL BUSINESS

THURSDAY, APRIL 29, 1999

U.S. HOUSE OF REPRESENTATIVES,
COMMITTEE ON SMALL BUSINESS,
Washington, DC.

The Committee met at 9:00 a.m., in room 2360 of the Rayburn House Office Building, the Honorable Jim Talent, Chairman of the Committee, presiding.

Chairman TALENT. The hearing will come to order.

I'll convene the hearing of the Small Business Committee, another in a series of hearings on the global warming protocol, otherwise known as the Kyoto Protocol.

In December of 1997, at Kyoto, the United States agreed as part of a protocol to reduce its production of greenhouse gases to approximately seven percent below 1990 levels.

Dr. Janet Yellen, the Chair of the Council of Economic Advisors, was here in June of 1998 to testify regarding the economic impact of that protocol, and she offered her observations at that time.

She had not at that time published for public consumption the economic analysis underlying her conclusions. She has since done so and so we've asked her to return so we can ask her questions about that analysis.

She has kindly agreed to do so.

However, Dr. Yellen is on a short timeframe so rather than make a formal opening statement, I'll just submit something for the record later and then I'll yield to my friend and colleague, the distinguished Ranking Member, for any comments she may wish to make.

[Mr. Talent's statement may be found in the appendix.]

Ms. VELAZQUEZ. Thank you, Mr. Chairman.

I would like to thank you for holding this hearing. It is important that the Committee review the Kyoto Protocol in the context of our nation's small business.

As we do, we should keep an open mind and take into account not only the potential negative effects it might have, but the positive opportunities it can bring.

The effects of greenhouse gases on our environment are becoming more and more evident. During the last century, the earth's temperature has risen by one degree Fahrenheit.

While this might not seem a lot to you or I, in the delicate balance of nature, it is significant. Furthermore, the forecast for the future predicts this rise to continue, with scientists estimating that temperatures will continue to rise another 1.8 to 6.3 degrees over the next century.

This fundamental change in the environment has started to cause some serious problems. Shifts in agricultural growth conditions are beginning to rob regions of their ability to produce food.

There has been a reduction in the ability of fresh water and we have seen an increase in the range and incidence of disease.

Estimates show that by the year 2100, we may see 50 to 80 million more cases of malaria alone.

If these trends go unchecked, so will the threat to human health. Unfortunately, these problems show no signs of going away on their own, which means we cannot ignore them.

On December 10th, 1997, the United States, along with leaders from 161 other nations, concluded the Kyoto Protocol. This agreement sets binding targets for the reductions of emissions of greenhouse gases world-wide.

It was an important first step and a good place to start. The Administration itself has acknowledged, however, that Kyoto is not perfect and it's still a work in progress.

The flexibility and enforcement of emission reductions that the Administration secured were important in creating a workable solution to the problem of global warming.

But the protocol did not include developing nations in the framework and the Administration is working to correct that.

The President has also stated that he will not send the treaty to the Senate until other nations, notably China, have agreed to emission reductions.

These are problems and they're being addressed.

From a domestic standpoint, we have different issues to consider. The last time this Committee examined the economic impact of the Kyoto Protocol, we did not have a study detailing the cost of implementing the treaty.

As a result, there were justifiable concerns regarding how much Kyoto will cost America's small business community. Today, we have a detailed study about the potential cost of the treaty for American businesses and consumers which we can now incorporate into our debate. These statistics are especially important to me.

As the Ranking Member of the Small Business Committee, I have concerns about the impact of the Kyoto Protocol on America's small business community and I know that the Chairman shares my concerns.

Small- and medium-sized businesses should not be asked to pay an unfair share of the burden of reducing global warming. But examining this issue in only negative terms is too limiting. I believe we should also look at how the protocol might have created new opportunities for small enterprises that focus on green technology.

Entrepreneurs have always been at the forefront of innovation and have been able to meet new technological challenges. I believe that stricter emissions standards may offer opportunities to countless small businesses who are working to innovate new environmentally sound technologies.

Finally, Mr. Chairman, I believe it is not productive for us to simply criticize the treaty without offering an alternative. If the answers that lay in this agreement are unworkable, then I am interested in hearing others.

Congress cannot just sit idly by criticizing without offering other solutions.

Let me close by once again thanking the Chairman for holding this hearing and I'm looking forward to the testimonies offered today.

Chairman TALENT. I thank the gentlelady for her comments.

And I'll just say that while I have been critical, I certainly haven't been idle. [Laughter.]

I appreciate the gentlelady's comments. We'll go to Dr. Yellen.

Dr. Yellen, I gave up my opening statement, which for a member of Congress and the chairman of a committee, is a great sacrifice because I understand that you have to leave. You're on a time schedule. You need to leave about 10:30 or so.

Dr. YELLEN. Yes, I do.

Chairman TALENT. So, in view of my sacrifice, I hope you will be conscientious in summarizing your testimony for us and keeping it brief.

Because, assuming members come, I want them to have the opportunity to ask you questions.

Thank you. You can proceed.

STATEMENT OF DR. JANET YELLEN, CHAIR, COUNCIL OF ECONOMIC ADVISERS

Dr. YELLEN. Thank you, Mr. Chairman. I appreciate your accommodating my schedule this morning. I'll try to be brief and I'd ask that my full testimony be included in the record.

Chairman TALENT. Without objection.

Dr. YELLEN. I appreciate having this opportunity to discuss with you the economics of climate change and the Administration's efforts to address this significant environmental challenge.

As you mentioned, the Administration released a report last July entitled, The Kyoto Protocol and the President's Policies to Address Climate Change.

In addition, since the Kyoto Conference, a variety of research on the economics of Kyoto, and especially on the economics of Kyoto's flexibility mechanisms, has been undertaken.

Today, I'll provide a brief summary of the Administration's economic analysis and review several of the key findings in the recent economic literature on climate change.

The Administration's economic analysis found that the economic cost of attaining targets and timetables specified in the Kyoto Protocol will be modest for the United States in aggregate and for typical households, assuming that effective mechanisms for international trading, joint implementation, and the clean development mechanism are established and also assuming that the United States achieves meaningful participation by key developing countries.

An illustrative assessment using the Second Generation Model that accounts for effective trading and developing country participation yields permit price estimates ranging between $14 and $23 a ton, and direct resource costs to the United States between $7 billion and $12 billion per year.

Under the assumptions of the Administration's analysis, permit prices in this range translate into energy price increases at the household level between three and five percent, but this would be roughly offset by the Administration's electricity restructuring proposal. I'd be happy to further discuss these results during the questioning period.

Since December, 1997, many economists have conducted and made available their analyses of the Kyoto Protocol.

For example, the Stanford University Energy Modeling Forum, the so-called EMF, which is a long-running model comparison exercise involving many of the leading climate and energy models, has coordinated full-scale analyses of the Kyoto Protocol with 12 global models.

Further, the Organization for Economic Cooperation and Development, the OECD, has published the proceedings of the Economic Modeling Workshop it sponsored last fall. The modeling results from the EMF and OECD provide very useful context for the Administration's economic analysis.

First, the illustrative model used by the Administration, the Second Generation Model of the Pacific Northwest National Laboratory, tends to fall in the middle of the range of the EMF models in terms of U.S. permit prices.

Under Annex I trading, the SGM permit price is at the median of this set of models and under full global trading, it is just below the median permit price.

Second, both modeling exercises found that the reduction in permit prices as trading expands from no trading to Annex I trading to full global trading, is robust.

On average, the EMF models found that Annex I trading would cut the U.S. permit price by 60 percent relative to a no-trading scenario, while the OECD models found a 57 percent average price reduction.

In full global trading, the permit price would be, on average, 81 percent lower than the no-trading price.

Several EMF modeling teams have considered the impact of constraints on the opportunity to buy or sell emissions allowances in the international market. While the United States is unambiguously opposed to trading restrictions, several parties to the agreement have indicated support for some form of a trading constraint. Trading restrictions would generate no benefit for the global climate while they could significantly increase the costs of achieving the Kyoto targets.

In my written testimony, I describe two examples of trading constraints where the U.S. permit price would increase by up to four times that of the unconstrained price.

Chairman TALENT. Just yield for just a second.

The European Union, for example, wants caps on what you can buy, right, under this kind of thing?

Dr. YELLEN. That's correct.

Chairman TALENT. So that that's an example of one of the countries that wants restrictions.

Dr. YELLEN. Precisely.

Chairman TALENT. Thank you. I'm sorry.

Dr. YELLEN. Absolutely. That's exactly what I had in mind.

Most models used to evaluate the Kyoto Protocol only focus on carbon dioxide emissions and do not account for the six types of greenhouse gases comprising Kyoto Targets and the opportunity to trade across gases.

However, recent work by a group a researchers at MIT has found that including the opportunity to abate noncarbon dioxide greenhouse gas emissions and promote carbon sinks reduces the cost to the United States by about 25 percent relative to a carbon dioxide only approach.

Other recent research has found similar results.

The EMF modeling indicates that economic and environmental benefits could accrue to some developing countries if they adopt emissions targets. Setting a binding emissions target would generate climate benefits by reducing global emissions below what they otherwise would have been.

In addition, if the target is set not too far below the business-as-usual emissions level, the participation of the country in the global trading system would produce economic benefits or gains from trade for both the developing country and its trading partners, such as the United States.

Annex I countries and private firms in these countries who would purchase these emissions allowances in the world market would achieve their targets at lower cost than without the participation of the developing countries.

The Administration's overall conclusion is that the economic impact of the protocol would be modest under the conditions we've identified in our economic analysis. And the purpose of my testimony has been to summarize the analysis we presented in the Administration Economic Analysis on climate change and to provide a brief update on recent analytic efforts outside the government.

I look forward to continuing to work with members of this Committee and other interested parties in further analyzing the Kyoto Protocol and evaluating the economic impacts of reducing greenhouse gas emissions.

It is my hope that economic analysis can continue to play a key role in designing policies in this area.

Let me stop there and I will welcome your questions.

[Dr. Yellen's statement may be found in the appendix.]

Chairman TALENT. Thank you, Dr. Yellen, for summarizing your testimony.

I have questions in a lot of areas. But I think, given your short timeframe and the faithful attendance of my friends on the Democratic side of the aisle—and I congratulate you for being here—and we're going to try and speak to some of those on our side of the aisle about whether they might want to emulate your model. [Laughter.]

I certainly want these members to have a chance to ask questions.

So I think I'll go into probably the area of my prime concern, which is this whole issue of meaningful participation.

This is the analysis you referred to, right? And this is the Administration's analysis.

Dr. YELLEN. Let's see.

Chairman TALENT. The Kyoto Protocol and the President's Policies. Okay. You have it in a different binder.

I want to be certain about what it was that we were dealing with.

And as I understand it, one of the assumptions you make—I'm going to try and short-circuit some of this, again, in view of the time constraints.

In reaching your conclusions, one of the assumptions you make is that we can secure "meaningful participation," and I'll put quotes around that because that's something I want to go into, by key developing countries. Other things also, the clean development mechanism, joint implementation, the joint trading agreement.

But for the purpose of my questions, I'm going to talk mostly about the assumption that we'll get meaningful participation by key developing countries.

That's one of the assumptions underlying your analysis. Isn't that correct?

Dr. YELLEN. It is one of the assumptions underlying the numerical results that I indicated to you of permit prices in the $14 to $23 range.

Chairman TALENT. Okay. Now let's go into what are the key developing countries.

What are some of the key developing countries?

Dr. YELLEN. Well, that remains to be determined in negotiations.

In the context of our model, we had to use the constraints of the Second Generation Model, which only enables us to look at a number of countries in the developing country bloc.

Particularly, it enabled us to look at China, India, Mexico and Korea.

Chairman TALENT. Right.

Dr. YELLEN. And those were ones that we identified. But in terms of our negotiations, we would have to see where things go.

Chairman TALENT. There could be others. But those are four of the key developing countries—China, Korea, India and Mexico.

That's what I understood as well.

So we're not talking about just extremely poor countries of sub-Saharan Africa or some very poor countries in Asia. We're talking about developing countries or countries that some might consider to be first-world countries, like Korea.

But China, Korea, India and Mexico are examples of key developing countries.

Dr. YELLEN. Well, in our analysis.

Chairman TALENT. Right. I understand.

And as I understand it, the reasons why meaningful participation is necessary is—and I get this from your testimony, so let me go through it and make sure I understand it—one of them is just as simple as a matter of science and environmental science. We can't do it without them. In other words, even if we restrict our production of greenhouse gases, if they have unlimited increases, since this is a global problem, we've achieved nothing.

So probably the number-one reason is that we can't do it scientifically without them.

Is that right?

Dr. YELLEN. In the long run, that's certainly true.

Chairman TALENT. And also, it's key to our ability to comply with our own targeted emission restrictions at a reasonable cost because your analysis depends on this international trading system where they're able to sell us credits because they've reduced below their targeted emission levels.

That's another reason, isn't it, to make this international trading scheme work?

Dr. YELLEN. Well, I'd like to clarify that.

Our analysis and the results that I describe that show permit prices in the $14 to $23 range, do assume participation by key countries and their inclusion in an international emissions trading system.

And that certainly is critical to generating prices as low as I mentioned.

However, what my testimony and outside research points out is that even without the participation of any non Annex I countries, that international trading that is already included in the agreement by Annex I countries alone, results in a very, very substantial reduction in costs.

The EMF exercise, 12 models that I report in my testimony, showed a 60-percent reduction in costs that comes from Annex I trading——

Chairman TALENT. Which are essentially the European countries.

That's correct, right? And I recall reading that. So you get a substantial reduction even if only the European countries are participating.

Dr. YELLEN. That's right. That also includes Russia and the former Soviet Union.

So, specifically, in the context of the model results that we report in this analysis, even if we had trading only in the Annex I countries, or under an umbrella that excluded the European Union, we would be looking at permit prices perhaps in the $30 to $55 range.

Chairman TALENT. Right.

Dr. YELLEN. Which I would hesitate to label as modest, but still is very much lower than the kinds of——

Chairman TALENT. I'll modify what I said. We can't get down to—I think it's like a 90-percent reduction we can get if we have the key developing countries participating.

Dr. YELLEN. That's right.

Chairman TALENT. And another reason is, you've testified before, is just the fairness. This is a global problem and the burden should be shared globally.

So those are three reasons why we need meaningful participation by key developing countries.

Am I correct?

Dr. YELLEN. Yes, although I think it's fair to say that given differences in per-capita income levels, the burdens should not be equally shared at this time.

The developing countries have, countries like China and India, much lower levels of per-capita income and I think different burdens at the present time given those different income levels.

Chairman TALENT. Let's get to that because we've talked about which are the key developing countries and why meaningful participation is important.

Let's discuss what meaningful participation is.

I'll preface that by saying I don't see it in the protocol. I see the international trading in the protocol, the clean development mechanism, the joint implementation in the protocol, but not the meaningful participation. And that's because that's not yet a globally-accepted term, is it?

Dr. YELLEN. That's right.

Chairman TALENT. That's our term.

Dr. YELLEN. Yes. The Senate has made it very clear and for the reasons you've given, it's clear to us, and to the Administration as well, that it is important to achieve meaningful developing country participation.

And that is something that the Administration continues to work on very hard in multi-lateral, bi-lateral and other fora.

Chairman TALENT. So what is meaningful participation? How do we define that?

Dr. YELLEN. I don't want to offer at this time a definition of what it means on behalf of the Administration.

In the context of the model results that underlie the Administration's economic analysis for a modeling purpose, we have taken it to mean that key developing countries take on binding targets close to their business-as-usual levels.

And what that enables them to do is to participate in international emissions trading.

Those countries are low-cost abaters and they do a lot of abatement. They sell the United States and other developed countries emissions permits. And there are gains for us in being able to carry out our job at lower expense.

There are gains for those countries.

And essentially, that's what it means.

Chairman TALENT. Now we're getting to the guts of one of my concerns that you started to refer to before.

We've agreed in this that we're going to reduce our emissions to seven percent below 1990 levels. And your economic analysis assumes that these key developing countries will be able to go on with business as usual.

In other words, they will be able to produce as many greenhouse gases, as much tonnage of greenhouse gases as they would if there wasn't a Kyoto Protocol.

It doesn't sound like a very good deal for us.

Dr. YELLEN. Well, as a benchmark, it seems to me that if we could convince developing countries—remember we're in the first stage of what will be a very long-term task of abating emissions. This is the first commitment period. It certainly can't be the last if we're going to succeed in this task.

But to ask developing countries in the early stages to take on targets that are somewhat below their business-as-usual paths, would produce environmental gains relative to the Kyoto treaty, so we would have greater reductions in greenhouse gases than those agreed to by the Annex I countries. In addition, there would be gains all around in the sense that it would be less expensive for us to carry out our commitments and there would also be gains, economic gains, to those countries from abating their emissions and they would abate them further than they would be required to because for them there would be a clear economic gain given they are growing rapidly. These developing countries do have easy, cheap opportunities as they grow to put into place energy-efficient investments, and they would have a clear incentive to undertake greater reductions than they were obliged to do in those targets.

Chairman TALENT. It still seems like a lousy deal to me. We could get, I guess, a better deal than that.

You're assuming this for the purposes of the analysis. But I guess it's possible that we can get a better deal.

Dr. YELLEN. Well, we are engaged in discussions with developing countries and trying to convince them and educate them that—their participation is important and that they can participate in a way that will not require them to sacrifice their economic growth.

Chairman TALENT. I'm concerned about us getting a worse deal. And I don't think our education plan is working.

Here's a letter from the Indian ambassador, the last sentence of which, and I can show it to you if you want to. It says, "India is not engaged in bilateral discussions on emissions with any country, nor do we support efforts to obtain pledges which go beyond the convention and also the Kyoto Protocol which don't contain meaningful participation at this point.

In fact, the framework convention authorized developing countries to raise their emissions to meet their social and developmental concerns."

And that's dated April 13th, 1999.

[The letter may be found in the appendix.]

Chairman TALENT. I'm really concerned that we may not even get business as usual.

Are you?

Dr. YELLEN. Well, clearly, this is an effort that's important for us to undertake.

I don't want to discuss the state of our diplomatic negotiations. I think it's more important for my colleagues from the State Department to discuss the state of diplomacy in this area.

I would say simply from my own standpoint, I have been involved in a number of discussions with officials from key developing countries, including China. And while official positions may not have changed, I think there is a growing understanding among developing countries that this can be a win-win deal in which they achieve some benefits and also help in combating the problem of growing greenhouse gas emissions.

There's no doubt that we have substantial——

Chairman TALENT. Dr. Yellen, I'm going to say if we're at seven percent below 1990 levels and they're at business as usual, it doesn't sound like a win-win.

It sounds like we lose, they win.

Dr. YELLEN. Well——

Chairman TALENT. I mean, why should we have to bear all the burdens. Because we happen to be a developed economy? We happen to have produced a lot?

We happen, for example, to have won the Second World War along with our allies, so that a lot of these countries—Korea wouldn't be a free country if it wasn't for the production that we've had and what we did for them.

So why are we conceding as part of our analysis that they're going to be able to operate at business-as-usual levels?

That's not even environmentally sound.

Dr. YELLEN. In the analysis, we have taken that as a benchmark and clearly indicated it.

It seems to me that in discussions with developing countries, we should be looking for some reductions below that. That would result in the clear environmental benefit beyond what was negotiated at Kyoto.

I think it seems clear to me, and I think the Byrd-Hagel resolution recognizes, that a one-size-fits-all approach for countries at very different states of development is not necessarily called for.

Chairman TALENT. All right. Well, let me leave that and get into how the trading system would work, assuming we get the participation. I guess this would be the case even if we don't get the key developing countries and we have the Annex I countries.

As I understand it, if I had a manufacturer in my district, big or small—I was going to use Chrysler because we have a plant, or Ford—but it would actually apply to small businesses, too, and he wants to expand, he or she, that person would have to get a credit under this trading system. And they would buy that from something like a foreign exchange.

Is that what you would anticipate happening?

Dr. YELLEN. Well, to know what a Ford or a General Motors or a small business would have to do, we would have to have greater specificity about how a domestic permit system would work.

That has not yet been discussed.

It's conceivable that a permit system could work in a way that would require sellers of fossil fuels to obtain permits.

For example, to sell a ton of coal, you would have to have a permit. Or to sell or import a barrel of oil would require a permit, in which case General Motors, Ford, and the typical small business would face no requirements to ever have permits for anything at all.

Those requirements would have been leveled upstream.

But it is also possible that the requirements could be leveled downstream for holding permits so that it is conceivable in some designs that a Ford or a GM would need permits for emissions. And the idea would be that markets would develop for these permits. They would be traded in markets just in the same way that permits for sulfur dioxide are currently traded and one can call up a broker and obtain permits.

Chairman TALENT. Except that that's a domestic trading system.

Dr. YELLEN. Domestic trading system?

Chairman TALENT. The concern that I want to get at is that somebody—and I like it a little better if it's done upstream—but somebody's going to be getting a permit from a foreign country or a foreign exchange before they're allowed to expand a plant in the United States, or build a new manufacturing facility in the United States.

Dr. YELLEN. We would have the ability to purchase permits from foreign countries that took on targets or that earned them as a result of Clean Development Mechanism projects that had verified credits.

And I believe what would happen is that a trading system and specialists would develop who would obtain those permits abroad and sell them here into a trading system so that a General Motors would have no obligation to be negotiating with foreign entities.

Chairman TALENT. Right. It's possible that our government might buy permits and be an agent.

Is that another way it might work?

Dr. YELLEN. Well, the design of the system remains unclear. But potentially, this is something that could be handled entirely by the private sector.

And there has been a substantial amount of interest by organized exchanges and by the financial community in seeing a market of this sort set up.

I think they feel that in the case of SO_2 permits, this is a mechanism that has worked very well.

Chairman TALENT. I think you can see my concern.

Dr. YELLEN. Sure.

Chairman TALENT. Making American companies buy directly or indirectly from foreign companies before they can—we might have an interest in them not expanding a particular facility.

And here's another possibility. Let's take a manufacturing facility in my district.

It might decide, well, you know—let's take Chrysler. They might decide it's really not worth buying that permit so we can expand this facility in the United States. We'll move to Mexico, particularly—let's suppose Mexico is a key developing country that hasn't agreed to participate as part of Kyoto, but we've gone ahead and done it anyway because of the other countries.

So Chrysler says, "we're going to go to Mexico because we don't have to pay the permit fee there. And not only that. Maybe our government set up the system so that because we're producing fewer cars in the United States because we've moved to Mexico, we're emitting fewer greenhouse gases in the United States. We get a domestic credit for that. So we save the permit fee by going to another country."

They might even get a domestic credit by leaving our country and our jobs go offshore.

And Mexico isn't a part of the Kyoto Protocol, so it's producing as many greenhouse gases as it wants.

You see my concern here? I'm not trying to just be critical for the sake of it. I'm concerned about our jobs. And I see this trading scheme and I see our jobs going overseas.

Dr. YELLEN. I think you're right to be concerned about the competitiveness and jobs in the United States.

We're equally concerned, I believe, about jobs in the United States and avoiding incentives for American firms to move abroad. That would not be a win for the economy and it wouldn't be a win for the environment, either.

I think the first point is that the strength of that incentive, even assuming that developing countries do not take on targets, depends on the impact of these agreements on permit prices and on energy prices in the United States.

That's why it is important to look at the economics of the agreement and to try to reassure ourselves that these obligations can be met without having a substantial effect on U.S. GDP or on energy prices.

And that's why my conclusion that the impact on energy prices will be small is critical.

I think, if I'm right about that, the energy price changes in the United States would not be large enough to rate as a substantial factor in the decision of a General Motors or a Ford as to where to put their plant.

Chairman TALENT. I agree. That is critical. Let me get to that.

And I appreciate the Committee's indulgence. I'll be done in a minute or two. As many have here, I've done a lot of work on this. I didn't know Dr. Yellen's time would be short. She indicated that to us a couple of days ago.

I'm happy, if we can't get to all members, to reconvene the hearing and ask her to come back. I'll be finished in a moment or two, and then I'll recognize the gentlelady from New York for as many questions as she may wish to ask.

Let's get to that, the impact of this international trading system, in your judgement.

Now, as I understand it, you believe, and I think this is the best-case scenario, although there are other scenarios which also would save money. But your best-case scenario, as I understand it, if we have key developing country participation and this international trading system, this would be with, what, Annex—the umbrella with eastern Europe and the key developing countries—is that the cost of a credit on an international market like that would be as long as a range—and I understand why you have to give a range—of $14 to $23 per ton of greenhouse gases saved.

Is that correct?

Dr. YELLEN. The range depends on whether or not the European Union would participate in Annex I trading or not.

Chairman TALENT. And that's the best possible scenario. There are other scenarios as well, but that's the best that you think you can get.

And that would be a reduction by a factor of about ten, would it not, of what the cost would otherwise be of the permit and the cost of compliance.

Is that correct?

Dr. YELLEN. That's roughly right.

Chairman TALENT. So about a 90-percent reduction. So it would be ten times as much if we don't have this trading system in place.

Is that correct?

Dr. YELLEN. Well, as I indicate, the Kyoto Protocol allows for Annex I trading.

Chairman TALENT. Right.

Dr. YELLEN. And even if we did not have meaningful developing country participation, which of course, it is the Clinton Administration policy to obtain. But even without it, the permit price would likely not be anything like ten times as large with Annex I trading or under an umbrella.

Without participation by developing countries, the range would be on the order of $29 to $54.

But even there, we're ignoring the possibility of sinks, sinks and other features of the Climate Change Technology Initiative to lower that.

So that's purely a model-based estimate.

To get up to ten times the figure that you're talking about, one would have to assume that none of the flexibility features of Kyoto were taken advantage of.

Chairman TALENT. Okay. I was just looking at your analysis on page 52, where it says, permit prices and resource costs relative to domestic-only abatement of various trading scenarios.

Dr. YELLEN. Yes.

Chairman TALENT. And you have a 93-percent reduction.

Dr. YELLEN. Yes.

Chairman TALENT. And I think there's another——

Dr. YELLEN. But just notice that the top line indicates that simply with Annex I trading or under the umbrella, that the percent reduction in permit prices are 72 to 85 percent.

Chairman TALENT. Then I was also going in response, in answer to a question that was in our first written questions to you, in which we asked about the costs, energy costs, assuming emission trading is not allowed.

And I won't read the whole answer, but the last sentence is: We believe that this difference of nearly a factor of ten underscores the importance of international permit trading and developing country participation, two cornerstones of the Administration's climate change policies.

So the key, as you said, the critical key to this is the trading system. Because you say here on For the analysis reported here, the Administration employed a conservative assumption that all country sinks equaled zero.

Dr. YELLEN. That's right.

Chairman TALENT. And that no country would implement policies to stimulate the creation of carbon sinks.

Dr. YELLEN. We assume that because we don't yet have good estimates of how sinks will work and what we will get out of them.

But I think sinks offer the potential to bring down the costs very substantially.

Chairman TALENT. Right. But the 93-percent reduction was without sinks.

Dr. YELLEN. The 93-percent reduction is without sinks with trading under the umbrella and with key developing countries included.

But even without the developing countries, the point that I want to make sure that I get across is you can see in line 2 on the chart on page 52, that costs are reduced by 85 percent.

That's utilizing the trading, international emissions trading within Annex I.

Chairman TALENT. And that surprised me because Japan has agreed to reduce its emissions to six percent below 1990 levels.

The European Union had agreed to reduce its emissions to eight percent below 1990 levels.

Canada had agreed to reduce its emissions to six percent below levels.

And if you take those three and combine them with the United States—I don't have the figure—that's got to be 80 percent of the world's Gross National Product, or the Gross International Product, whatever you economists call it.

So I was wondering how, if 80 percent of the world's economy were buyers and a maximum of 20 percent of the world's economy were sellers, where we're going to get a reduction of 90 percent in the permit prices.

Dr. YELLEN. Well, Russia and the former Soviet Union are also included in this scheme and use energy extremely inefficiently.

And on top of that, their economies have done very badly. So, they are potential sellers of permits to all of these countries.

Chairman TALENT. That still leaves 80 percent of the world buying. Right? And 20 percent of the world selling.

Dr. YELLEN. Well, what I can report to you are that, for example, beyond our own analysis, and this is why in my remarks this morning, I thought it important to provide some context for our estimates by telling you about a much wider range of analysis that's now available of this protocol.

Chairman TALENT. But this is the analysis of the Administration, and this is what we're talking about.

Dr. YELLEN. Yes.

Chairman TALENT. I'm not talking about Stanford's analysis. I'm talking about your analysis.

Dr. YELLEN. Yes. I agree. And I'm simply telling you that our analysis falls right in the middle of a wide range of results that are now available.

And so——

Chairman TALENT. Is that because, by the way, and I want to finish for the other members. I'm hurrying here, believe it or not.

Is that because the European countries will be able to sell to us—when you mention Annex I countries trading, it's your anticipation that they will be sellers to us.

Right?

Dr. YELLEN. We would be net purchasers from other Annex I countries. Clearly we would be net purchasers from the former Soviet Union and Eastern Europe.

And Japan, my guess is, would likely be a net buyer. And Europe—it depends on whether they are included or not. They might well be net buyers as well.

Chairman TALENT. What's your estimate regarding demand for emission credits in this critical period, world demand, say, in 2008 through 2012?

We always use 2010 because that's the midway period in the compliance period.

So what's the estimate you had for world demand for emission credits in this critical period?

Dr. YELLEN. That's not a number I can give you without doing some work to find it. I don't have that at my fingertips.

I'll try to——

Chairman TALENT. Is that in the analysis?

Dr. YELLEN. The world demand.

Chairman TALENT. It isn't, is it?

Dr. YELLEN. Well, implicitly, that's something that models generate, is they look to see what the demand for trading is.

But it's not something that we've focused on.

Chairman TALENT. Well, you see, I think that's pretty important because you don't have an estimate for world supply, either, do you?

Dr. YELLEN. Well, that is something that's included in these markets.

Demand depends——

Chairman TALENT. It's not included in your analysis.

Dr. YELLEN. It is included in the analysis implicitly, although I've not reported to you the numbers that come out of the models.

Chairman TALENT. We asked you, the Committee asked you, in a written question for estimates of the U.S. demand for emission credits by year for the period, 2008 through 2012. And we asked for the potential supply from Russia and the Ukraine.

And here was your answer: The Administration has no estimates of the demand for emission credits by year for the period, 2008 through 2012. Demand will be sensitive to a variety of factors that are quite different to forecast ten to fourteen years in advance, especially the rate of technological innovation and the diffusion and adoption of current innovations and those placed on the market over the next ten years.

For the same reason, we have no estimates of the supply of emission credits.

Dr. YELLEN. Well, I think we have to distinguish two things.

One is the results that come out of the model, which we have reams of computer output on.

Another question is what is our best judgment about what is likely to happen in reality under this agreement, if it's ratified.

What we've tried to do in this analysis is to assure ourselves that the cost of this agreement can be modest. And we believe that we've made that case effectively.

However, what will the trading actually be? It depends on a host of factors we've quite openly admitted we have not yet taken into account, like sinks.

So if you asked me what does the computer simulation say about those questions of trading, that's something I can answer. But what do I think will really happen, I want to wait to find out what happens with sinks.

It depends on the——

Chairman TALENT. I guess I'm not an economist. I don't know how you can estimate price without having estimates for supply and demand.

Dr. YELLEN. There are supply and demand estimates included in the models and that is how these prices were generated.

Chairman TALENT. Well, I guess there was some misunderstanding and mistaken answer to this question, because you say that the Administration has no estimates of the demand for emission credits.

Dr. YELLEN. The models contain estimates. And the ones that were used to produce the numbers here do contain estimates.

Chairman TALENT. And can we have those estimates in response to this question?

Dr. YELLEN. We'll try to provide you with some estimates. We'll see what we can do. Understanding they are model results and not the Administration's judgments about what will really happen when the treaty is workable and sinks provisions and other things have been clarified.

Chairman TALENT. I thank the Committee for its indulgence. I don't normally take such advantage of the Chairman's privilege to ask questions, but this is an area that does concern me.

And I'll be happy now to recognize the gentlelady from New York for any questions she may wish to ask.

Ms. VELAZQUEZ. Thank you, Mr. Chairman.

And I just would like to request that maybe we should have another hearing so that the members on my side are given an opportunity to ask questions. They were here on time and I don't think it's fair that she has to leave by 10:30.

Chairman TALENT. As I mentioned before, that was not my understanding. Dr. Yellen indicated a couple of days ago that she would have to leave by 10:30.

I'm more than happy to reconvene the hearing if members desire it.

Ms. VELAZQUEZ. Thank you.

Chairman TALENT. In fact, I was originally thinking of postponing it until she had more time. But I thought we'd do what we could do now.

Ms. VELAZQUEZ. Thank you. Dr. Yellen, the line of questioning that were asked by the Chairman basically are focusing on the cost of implementing Kyoto.

Can you please explain to us or share with us some of the conclusions that the world's scientists have come to with regard to the cost of inaction in this area?

Dr. YELLEN. Yes. I think that if we have inaction in this area and continue to allow concentrations of greenhouse gases, carbon dioxide, in the atmosphere to rise, while I'm not a scientist, I have looked at the literature in this topic, and some of the consequences would include rise in sea levels, increased incidence of severe weather events, such as hurricanes, stress on water supplies, giving rise to potential problems of availability of fresh water, stress on soil and moisture that can impact agriculture and the productivity of lands in complex ways around the globe, impacts on human health and incidence of disease.

And in addition to that, species loss and impact on biodiversity and ecosystems.

On top of that, there are frightening possibilities to consider. Presumably, low probability events, but potential catastrophes that are of grave concern, like shifting of ocean currents or substantial changes in the ice sheet in Antarctica, with potentially catastrophic, although small probabilities.

So I think all of those things are of concern.

And economists who have bravely attempted to put pricetags on those have concluded that a doubling of concentrations from preindustrial levels would likely produce a loss in world GDP of one percent, at least one percent, possibly more.

Ms. VELAZQUEZ. Do you know or are you aware whether the scientific and economic analysis on which you are relying are being called into question as seriously in other countries as it is the case here in the United States?

And if not, do you have any opinion as to why that might be?

Dr. YELLEN. Well, again, I'm not an expert on the science of it.

But my impression is that the scientific results underlying this are quite well accepted in other countries. I don't want to say that there is no scientific discussion or doubt, but the IPCC, the Intergovernmental Panel on Climate Change, which convened a group of experts to consider the science, has concluded that the science is sound and on top of that, there's a discernible human influence on climate.

Ms. VELAZQUEZ. By now, I guess you understand why critics are concerned that the phrase, meaningful participation, has needed to be defined more precisely.

And I guess you have explained this to your colleagues in the diplomatic community.

What can you tell us is their commitment?

Dr. YELLEN. The commitment of my colleagues?

Ms. VELAZQUEZ. Yes.

Dr. YELLEN. My colleagues are working extremely hard and have been for some time in every possible forum, from bilateral diplomatic consultations to multi-national, multi-lateral fora, to attempt to explain to developing countries the potential benefits to them of participating in this agreement, as well as the need to do so.

And while I agree we have not yet achieved it, it is something we understand the need for and are working on extremely hard.

Ms. VELAZQUEZ. I will finish with my line of questioning so that I can give opportunity to my side.

Chairman TALENT. Mr. Toomey?

Mr. TOOMEY. Thank you, Mr. Chairman. A couple of quick questions here.

On the first page of your testimony, there's a quote from the IPCC. And it says that their conclusion in 1995 was that the balance of evidence suggests that there is a discernible human influence on global climate.

My question is does the IPCC anywhere conclude specifically that the release of greenhouse gases by human industry has in fact raised global temperatures already?

Dr. YELLEN. I believe this is their summary of their findings. Namely, that looking at all the evidence, the balance of evidence, suggests that, yes, the human activity has resulted in changes in the global climate.

Mr. TOOMEY. Well, okay. It says, a balance of evidence. And that's an interesting choice of terms. It's not as strong a statement certainly as one could make.

And it also says it's a discernible human influence on global climate, which again is a curious way to describe it.

If there were a consensus and a conviction that there was in fact an increase in the global temperature, presumably, that would have been stated.

Dr. YELLEN. Well, I think there's no doubt that concentrations of carbon dioxide in the atmosphere have increased.

I don't think there can be very much dispute about that.

The question of what's caused that and whether or not there's a human influence, I believe this is the way they stated their conclusion.

Mr. TOOMEY. Right. And it seems to me that it leaves still unaddressed the question of whether that increase in the concentration of greenhouse gases has resulted in an increase in global temperature, or whether it has not.

And I guess my question is, is it fair to state that that is still an unresolved question in the scientific community as to whether or not there has in fact already been an increase in the global temperature, or whether the global temperature continues to fluctuate within a band that it has historically fluctuated within?

Dr. YELLEN. I think I'm not the right person to ask definitive questions to on the science. I would be happy to send one of my colleagues who is.

My own understanding is that the evidence shows both that carbon dioxide concentrations have increased and that temperatures as well have increased during the century.

That's my understanding of the scientific results. But I'm probably not the right person to press further on this issue.

Mr. TOOMEY. Okay. Fine. On another topic, I just wanted to follow up with some questions the Chairman had regarding the application to developing countries, particularly the business-as-usual concept.

Clearly, in recent history, in these countries, business-as-usual has meant an annual increase in the output of greenhouse gases.

Does business as usual mean that that annual increase would continue for these countries or that it imposes a cap at the current level of business?

Dr. YELLEN. Well, business as usual means a baseline in which no obligations are imposed on these countries and they continue to grow according to their best forecasts and use energy without policy changes.

That's what business as usual is.

That was the baseline for our estimates here. Presumably, if developing countries were willing to take on targets, it would be appropriate for them to cut off of a business-as-usual path to achieve global benefits.

You could think of business as usual for developing countries as a neutral for the world from an environmental standpoint.

But cuts off of business as usual by developing countries would represent the contribution by them to make further progress on the environment beyond what developed countries agreed to at Kyoto.

Mr. TOOMEY. Okay. Thank you. The last question I had was——

Chairman TALENT. If the gentleman would yield.

As Dr. Yellen testified before the Subcommittee on Energy and Power of the Committee on Commerce, and this is consistent with what she just said, but it may be a little clearer:

We presented results that assume that key developing countries take on binding quantitative targets, emissions targets.

These are the target, at their business-as-usual levels. Or close to them.

Dr. YELLEN. In the analysis, that's the targets.

Chairman TALENT. Right. So the analysis is predicated on them continuing to expand at what they would expand if there was no protocol.

Dr. YELLEN. Right.

Chairman TALENT. I thank the gentleman for yielding.

Mr. TOOMEY. Last question. The trading mechanism that your analysis envisions, as I understand it, would apply or could apply to the purchase—essentially, what amounts to a fee that would be applied to energy sources.

For instance, as you mentioned, a barrel of oil could require a permit to be paid for, or a unit of electricity, presumably, or coal or some other fuel.

Does this mechanism in any way contemplate that the way you use that oil or coal has potentially widely varying emissions of greenhouse gases?

For instance, if you take a barrel of oil and it's converted to gasoline and it's burned in a modern car, the same quantity of oil burned in a chainsaw has very different levels of emission.

Is that contemplated at all?

Dr. YELLEN. I believe it's the case that burning a ton of coal or a gallon of oil produces, if it's fully burned, produces a fixed quantity of carbon dioxide into the atmosphere.

And cars can be more or less efficient in their use of gas or electric power plants and their use of coal. But when a ton of coal is fully burned, it emits a fixed proportion of carbon dioxide into the atmosphere.

Those things are different. Coal is most intense in its emission of carbon dioxide. Oil less intense. And natural gas produces the least intense.

Mr. TOOMEY. Okay. Thank you.

Chairman TALENT. Mr. Baird was next.

Mr. BAIRD. Thank you, Mr. Chairman.

I have two fairly brief questions, but they may have long answers.

The first question is, my concern when we look at economic impacts as the topic of today's meeting, is when we speak in terms of macro-scale and talk about modest economic impact, my concern is, on the more micro-scale, specifically the communities where coal is the primary economic engine of that community.

Many of these communities are rural communities. In many cases, coal mining or a power system that depends upon coal is really the predominant job-creator there.

What can you tell us about two issues? First of all, what are the more localized economic impacts because, for me, they seem to be potentially profound.

And two, in your analysis, or the Administration plans, what steps can be offered to help these communities either cope with emission reductions or provide compensatory economic opportunities?

Dr. YELLEN. Did you want to talk about coal communities specifically?

Mr. BAIRD. It seems to me that that may be the most problematic area.

Dr. YELLEN. I think certainly to identify coal as the industry that is mostly likely to be affected by this policy is absolutely correct.

Having said that, coal has a very important place in this country's energy future.

The Kyoto Protocol would in no way change that. Coal in every forecast, ours and every other forecast that I've seen, continues to play a major role.

So I think that's the first thing to say.

I think it can continue to play an even more important role if we undertake research and development on clean coal technologies to make the use of coal increasingly efficient. And there are potential ways in which we might learn to sequester some of the emissions, the carbon dioxide emissions, from coal.

And the Administration has a research program in that area. And if there are pay-offs there, coal can have a growing place in the nation's energy picture.

Having said that, I think it's important to say first, coal is an industry that, with or without Kyoto, or climate change, has been under stress.

Employment has been diminishing in the coal industry for quite some time.

So these are communities that have been experiencing pain. They have mainly been experiencing pain because of very rapid productivity increases in the coal industry.

Nowadays, one can produce a ton of coal with many fewer workers than it required ten or 20 years ago. And that's why coal output has been going up and employment has been plunging.

That's the beginning picture.

Now, in the kind of scenario that we depict in this analysis with permit prices in the $14 to $23 a ton range, we've tried to look at what would happen to coal.

And the answer is that coal output would essentially level off over this commitment period rather than in the baseline, increase slightly.

So there would be a mildly negative impact on coal output.

But, still, there would not be an absolute decline in coal production in the United States.

All that said, the Administration is completely committed to working with the coal industry, with communities with affected workers, since they are the ones that are most likely to see an impact.

Mr. BAIRD. I would personally be interested in some material on the coal research projects for cleaner coal burning and how we can help the rural communities.

I appreciate that information.

The second question I would have is, as we look at the sale of the greenhouse gas credits in an international market, it seems to me rational to suggest that the profits from those sales be cycled back into measures to further reduce the greenhouse gases.

So sort of a two-part question.

One, who benefits from the marketing of the greenhouse gas credit? Who gets the money?

We put it on the market. Money comes in somewhere. Who gets that money? And to what end would it be put?

Dr. YELLEN. Well, I think when there's a market place, anyone that can produce something at lower than the market price and sell it, stands to make a profit.

And when you ask, who is it that stands to make a profit in a market like this, it would be anyone here in the United States—firms, households—or in the rest of the world, that look and say, wow, I can reduce my energy use, my greenhouse gas emissions cheaply. And if I do it, I then have the ability to sell a permit in the market place and take the gain as my profit.

So the gains would be very widely distributed. And of course, there would be incentives, I think, to pour a good share of the profits back into energy efficiency investments because it's those investments that would create the opportunity for further profits in that market place.

Mr. BAIRD. Thank you.

Thank you, Mr. Chairman.

Chairman TALENT. I think it would reduce production by just moving, closing down.

Ms. Kelly is next, because Mr. Forbes, although there's still signs of life over there—he's coming back.

So we'll go to Ms. Kelly in the meantime.

Mrs. KELLY. Thank you, Mr. Chairman.

I'm interested in the fact that the State Department has proposed that we have these tradable emission permits. And they would cover all of the household, commercial, industrial and agricultural and forestry sources of greenhouse gases.

Is that correct?

Dr. YELLEN. You're referring to——

Mrs. KELLY. I'm talking about emissions trading.

Dr. YELLEN [continuing]. The United States? Are you talking about international emissions trading?

Mrs. KELLY. Yes.

Dr. YELLEN. Or trading in the United States?

Mrs. KELLY. I'm talking about international.

Dr. YELLEN. Well, internationally, countries would have the ability to trade the permits to the extent that they cut their emissions below their agreed-upon targets.

Mrs. KELLY. All I'm interested in—I understand that. But all I'm interested in, it's my understanding that this covers all household, commercial, industrial and agriculture.

These are combined gases that we're talking about.

Dr. YELLEN. The aggregate emissions of these greenhouse gases by the country as a whole relative to the targets agreed upon in the treaties.

Mrs. KELLY. Okay. If that's the case, then I'd like to know who would be in charge of monitoring this. I'd like to know what's been thought through in terms of making some sort of monitoring, enforcing and deciding who's allocating how much, who's emitting how much.

What mechanism has been thought through in terms of enforcement?

Dr. YELLEN. Well, I think you've asked an important question. For a trading system to work, there has to be monitoring and assurance of compliance.

And there are a number of ways in which that could be brought about.

Mrs. KELLY. In your economic structure, though, I don't know. Maybe it's there in something that I haven't read. But I don't see anything in terms of the economics of what that cost would be.

Who would be involved? How many people? What we're talking about what the cost is?

I don't know what that economic burden is going to be and who's going to carry it.

And I'd like to know if you have any kind of an idea.

Dr. YELLEN. One of the tasks on the agenda at the next two conferences of parties, COP–S and COP–6, is to try to agree upon the rules governing international emissions trading.

That will get into and have the answer to the question you've asked about monitoring, enforcement, compliance, verification.

Mrs. KELLY. So we don't really have a good idea at this point of what that cost would be.

Dr. YELLEN. We've certainly not attempted to estimate that. The rules are not yet specified.

The Administration has often said that Kyoto is a work in progress. And what that means is that at Kyoto, the agreement contained a basic right for countries taking on Annex I targets to engage in international emissions trading.

But a system has to be devised to govern the rules governing that trading. And that work remains unfinished. And until it is finished, I can't give you an estimate. We've not tried to come up with one of what the cost would be of running the system.

Mrs. KELLY. Okay. I'm going to let that be because it's clear that there's nobody that understands what the cost to anyone in the world will be.

It concerns me that we're picking out a few nations here and not including all of the developing nations because there's a great deal of open burning in developing nations that put carbon gases in the atmosphere.

I'm very concerned about the fact that, from what I've read, I don't see anything that monitors that.

I'm going to go on to something else.

I want to know what steps the Administration has taken right now to put the Kyoto treaty into implementation.

Dr. YELLEN. The Administration has taken no steps to put the Kyoto treaty into implementation and would not do so until the treaty is ratified by the Senate.

Mrs. KELLY. So there's nothing going on, no intent to go ahead with this before it's ratified by the Senate.

Is that correct?

Dr. YELLEN. Absolutely not. I would say we do have obligations under the Framework Convention on Climate Change that gave us 1990 levels of emissions by 2000 as a goal. And a number of climate change programs of the government are consistent with that ongoing obligation which was ratified by the Senate.

But with respect to Kyoto, there would be no action undertaken until such time as that treaty is ratified by the Senate.

Mrs. KELLY. But you will go for goals that are included in the treaty without coming to the Senate.

Is that what I've just understood you to say?

Dr. YELLEN. I've said there are previous agreements that have generated programs. Previous agreements, not Kyoto.

Mrs. KELLY. When does the Administration plan to submit the treaty to the Senate?

Do we have an estimate?

Dr. YELLEN. We continue to work to implement in an effective way the Clean Development Mechanism, international trading, and we're committed to achieving meaningful developing country participation, and won't submit it to the Senate until we feel that we're there.

Mrs. KELLY. Thank you. My time is up. I have a number of other questions.

Chairman TALENT. And Dr. Yellen, with regard to the cost of this international trading system, wouldn't it be a good idea to have some analysis of that before we agree to something?

Dr. YELLEN. Well, ideally, we would have estimates of the economic impacts of everything. 2,500 economists signed a letter urging the United States to negotiate an agreement to limit greenhouse gases that would have such flexibility mechanisms because the experience that we've had with using it for environmental purposes here in the United States and markets generally, is that they work well and, on balance, greatly reduce the cost of meeting environmental and other goals.

Now there are some costs to running markets themselves and you're very right to point out that market systems require institutions and monitoring and compliance.

It's not costless.

But, on balance, the contribution of a market system of international trading to reducing costs is very great and I think it's something that we pushed for and were right to push for and insist on in the Kyoto Protocol.

Chairman TALENT. This analysis was published in July of 1998. Right?

Dr. YELLEN. Yes.

Chairman TALENT. Is that when you had it available? Is that when you had made the analysis, in July of 1998? Or had you made it before then?

Dr. YELLEN. We had undertaken a variety of kinds of economic analysis earlier. But this analysis reflects our understanding, an analysis of what was agreed to at Kyoto.

Obviously, it was a negotiation. And we only know what was agreed to when it's over. And so we've taken the key things that were agreed to and have tried to perform an analysis with that knowledge.

That doesn't mean that no economic analysis was done prior to going off to negotiate. That would be false.

Chairman TALENT. Okay. Well, I wondered about that because, in response to one of the questions from the Committee, you indicated that "all of the quantitative analyses underlying Dr. Yellen's testimony"—that was when you testified before the Committee in June of 1998—"were developed after Kyoto."

Dr. YELLEN. That's correct. That's what's in this document, this analysis. And in my earlier testimony, the results that I cited were the ones that are also given in this document that was later published.

All of that work was undertaken after Kyoto.

But it does not mean that the negotiations in Kyoto were uninformed by an understanding of economics.

That's my point.

Chairman TALENT. Okay. Thank you. I'll recognize—who is next?—Ms. Christian-Christensen is next.

Ms. CHRISTIAN-CHRISTENSEN. Thank you, Mr. Chairman. Good morning, Dr. Yellen.

Dr. YELLEN. Good morning.

Ms. CHRISTIAN-CHRISTENSEN. I wanted to follow up on a question about the flexibility mechanisms because you said in your testimony that during the development of the work plan last fall in Buenos Aires, it was decided to resolve key implementation issues regarding these flexibility mechanisms by the end of the year 2000.

Is resolving this by that time necessary before ratification efforts? And if so, does that bear on suggestions that we should renegotiate elements of Kyoto because the timeframe is becoming too constrained?

Dr. YELLEN. I think it is critical to resolve the issues about how international emissions trading will work and how the Clean Development Mechanism can work as a mechanism in implementing the Kyoto agreements.

So, clearly, these issues need to be resolved.

But I believe we can meet the commitments that we've made. If these issues are resolved by the end of 2000, which is the plan, I believe there's adequate time for us to set the things in motion that are necessary for us to meet our commitments in the first commitment period.

I think there's time that remains. And we are engaged now in discussions with industries that are willing to take on voluntary commitments. Certainly, many industries are thinking about Kyoto, are making their own plans with the knowledge that reduction of greenhouse gases is high on the environmental agenda, an important issue.

And so, while we've done nothing to implement Kyoto, I think it's fair to say that many industries, many firms, are looking to a future in which we are attempting world-wide to limit greenhouses gases in making their own investment decisions now.

And in that sense, we're already on the way to taking meaningful action to meet these goals.

Ms. CHRISTIAN-CHRISTENSEN. Thank you. I have one other question. Again, it follows up on a question that the Chairman—a concern of his, and of many critics, that the cost of implementing Kyoto and the U.S., because of the cost, employers will relocate facilities to the developing world, resulting in serious job losses and economic dislocations.

If you disagree with that conclusion, could you tell us what factors lead you to believe that major disruptions of this kind are not likely to occur?

Dr. YELLEN. It's a very important consideration. I disagree with the conclusion. I want to give three reasons.

First, that I believe the impact on energy prices will be so small as quantitatively, to be unimportant in driving international location decisions for firms.

That's number one.

Number two, many of the countries with whom we compete, the Annex I countries will be undertaking commitments like ours.

So, to the extent that there's some impact on energy prices here, there will be comparable impacts with many of our competitors.

Third, if we are successful in achieving meaningful developing country participation, and particularly if developing countries, key developing countries were to take on targets, that would work to level the playing field world-wide because countries that take on targets and participate in international trading will have the incentive to comparably raise energy prices to conserve on energy and to take advantage of the gains from that system.

So another reason for wanting the developing countries to participate in this system is to globally level the playing field so that you don't have the kind of relocations that you would be rightly concerned about.

Ms. CHRISTIAN-CHRISTENSEN. So you don't anticipate that Congress would need to consider programs to counteract the potential for those kind of dislocations at this point?

Dr. YELLEN. I don't believe that that should be in Congress' agenda at this time.

Ms. CHRISTIAN-CHRISTENSEN. Thank you.

Thank you, Mr. Chairman.

Chairman TALENT. Mr. Hill?

Mr. HILL. Thank you, Mr. Chairman. And thank you, Dr. Yellen, for being here.

Dr. Yellen, a year ago I asked you some questions about some assumptions that I had made, and I asked you to make comment on those, and if you disagreed with them. And you didn't.

So I presume that you agreed with them. And I just wanted to run through these again to make sure that my understanding of this is correct.

It's estimated that there are about 90 billion tons per year of carbon dioxide that comes from the oceans, about 30 billion tons of carbon dioxide that comes from decaying plants, and about 30 percent billions of carbon dioxide emitted into the atmosphere that comes from animal and plant activities separate from human activity.

And then about seven billion tons that comes from all the consumption of fossil fuels and from all of human activity.

That represents about five percent of the total carbon dioxide emissions that are coming from our activities and it's this five percent that we're substantially trying to deal with with the protocols at Kyoto, how we're going to manage this five percent.

Do you have any reason to disagree with those approximate numbers?

Dr. YELLEN. I don't have any information on those numbers here.

Mr. HILL. I would ask you again, if you do, maybe you would let the Committee know, as I asked you a year ago about that.

What I want to do is talk about the natural elements that are occurring out there because, basically, the numbers I've given you, about 150 billion tons of emissions coming from natural activities and 7 billion tons coming from other purposes.

It seems to me that if our goal is to try to reduce the carbon dioxide emissions, carbon dioxide build-up in the atmosphere, that we ought to be trying to analyze what's happening in the natural side.

The assumption here is that either there's become an imbalance in terms of those natural activities that consume the natural emissions, or that the accumulation of human activity has added to the increase in carbon dioxide in the atmosphere.

Would you agree with that? That's basically the assumption that Kyoto is based on.

Dr. YELLEN. Well, this is a scientific question that I'm probably not best qualified to comment on.

But you're certainly right that changes in land use and natural activities, along with human activity, matter to the build-up of greenhouse gases in the atmosphere.

That's certainly true. And that is one reason that carbon sinks are included in the Kyoto Protocol as a factor governing emissions.

We know that deforestation, for example, leads to an increase in greenhouse gas emissions in the atmosphere. That's why it's very important that the treaty recognize that we should take into account in computing countries' targets the factors governed by carbon sinks and changes in their release and absorption of carbon.

Mr. HILL. I don't want to argue that point with you. But deforestation reduces the natural processes that reduce the carbon in the atmosphere. Deforestation wouldn't necessarily increase carbon emissions.

But that's one of the things that I want to talk with you about because carbon dioxide that is released—a ton of carbon dioxide that comes from coal is no different than a ton of carbon dioxide that would come from oil or gas or from any other process, is it?

It's all the same.

Dr. YELLEN. Right.

Mr. HILL. There may be more BTUs. There may be different economic consequences of all those things. But in terms of the impact on the atmosphere, it would be the same.

Which brings me to the question that concerns me. And that is the question of sinks because, interestingly, in the protocol, our forest management practices were kind of left out.

In fact, they were carved out.

What we've learned in the Resources Committee, Dr. Yellen, is that we have catastrophic fire hazards in our national forests.

As a matter of fact, our national forests are subject to greater fire hazard today than any time in the history of the country. And that the Administration's policies are putting off for as long as 50 to 70 years eliminating these catastrophic fire hazards.

Now, clearly, a burning national forest adds to the carbon dioxide in the atmosphere, doesn't it?

If a forest burns, it's going to add carbon to the atmosphere.

Would you agree with that?

So preventing that fire from occurring, do you think it would be a good policy?

Dr. YELLEN. You know, I'm not qualified to talk about what the right way is to promote sink activity.

Mr. HILL. Even though the Kyoto Protocol suggests that sink activity is one of the significant ways that we can deal with the carbon dioxide issue.

In other words, what you're saying is that we should ignore that?

Dr. YELLEN. No. I think sinks are extremely important and forestry initiatives that are judged to be both cost effective and can help us meet our emissions targets certainly are important and ought to be part of our approach.

Mr. HILL. So the Administration's plan prescribed burning, to increase the burning of the forests.

How does that help us meet the emissions goal?

Dr. YELLEN. I'm sorry?

Mr. HILL. The Administration has a plan to substantially increase prescribed burning of our national forests.

Could you tell me how that's going to help us meet our emissions goal?

Dr. YELLEN. I'm not an expert on forestry management. And to discuss that, I really think I ought to send you somebody who's better qualified to discuss it than I am. I'd only point out that there are a number of different factors relating to forest management policy that have to be taken account of.

And on the issue of burning, I'm not the right person to ask that question to.

Mr. HILL. So you're not aware of any aspect of our current forest management practices that would help us meet those objectives.

Dr. YELLEN. I'm not knowledgeable enough on this topic to respond to your question.

I'd be happy to refer to this Committee somebody who can answer it.

Mr. HILL. The last thing, Mr. Chairman, before I go, your goal when you were here, there were a lot of questions that arose again in your testimony that members wanted to understand fully the economic assumptions and factors that you use for your projections because you're aware of the fact that there are other economic models out there that differ dramatically from what your economic models suggest.

Dr. YELLEN. Well, in fact, I've tried to summarize in my testimony this morning a great deal of economic research to help put our results in context.

And the conclusion that I reached and would be happy to justify in greater detail is that our results lie more or less in the middle of what a large number of analyses are saying about Kyoto.

Mr. HILL. Dr. Yellen, you know, it's said that if you have your feet in the refrigerator and your head in the oven, on average, your temperature is about right.

An average doesn't mean much and it certainly doesn't determine accuracy.

What we want to do is to get the factors so that we can make an analysis of the difference because even within the Administration, there are different conclusions that are drawn.

We need to first of all understand those factors and assumptions. Then we need to translate this into some sort of cost-benefit analysis that we can use to compare alternative strategies, including strategies that might increase the natural processes to reduce carbon dioxide build-up.

I thank you.

Thank you, Mr. Chairman.

Chairman TALENT. Next is Ms. Tubbs Jones.

Ms. TUBBS JONES. Thank you, Mr. Chairman.

I'm going to make my questions brief in order to give my colleague, Ms. Millender-McDonald, at least a couple of minutes to make an inquiry of you.

I want to go back to meaningful participation and get an understanding as to what meaningful participation in fact means by developing countries in this discussion about the Kyoto agreement.

Dr. YELLEN. I don't have a definition to give you of meaningful participation. But, certainly, if key countries would agree to take on targets, emissions targets, and to participate in international emissions trading, that would be sufficient, I believe, to constitute meaningful participation.

Ms. TUBBS JONES. Let me delve just a little bit deeper, then.

How many countries are we talking about in order to assess what meaningful participation is?

Dr. YELLEN. I don't have a pre-determined formula to give you.

I can tell you that there are hopeful signs in that there are some countries that have agreed to voluntarily take on targets that are not in Annex I.

Argentina and Kazakstan are two countries that have shown interest. And it is our hope, working diplomatically, intensively, that we will convince other countries.

And we understand that, in presenting a treaty to the Senate for ratification, which is what's required of the Administration, that it will be our job to make the case that we have achieved something that constitutes meaningful participation.

We will have to make that case.

Ms. TUBBS JONES. So as you sit here, you have no particular goal in mind.

Dr. YELLEN. I don't want to determine in advance, pre-judge precisely what that goal is.

But as I've indicated, we're working intensively diplomatically to attempt to draw developing countries into this treaty, so that we will be able to make the case when the time comes that we've achieved that.

Ms. TUBBS JONES. Then you recognize that your critics, by you responding as you're responding to me, say, well, what does that mean?

Dr. YELLEN. Yes.

Ms. TUBBS JONES. And so, I'm sure as a result of that, you are going to work on how we can better respond, those of us who are supportive of this agreement, to that issue.

Dr. YELLEN. Yes. I think it's our job to justify—I mean, at the moment we're engaged in intense diplomatic efforts to try to move developing countries to participate in this agreement in ways that will be beneficial for us and for them and satisfy the Senate that we have achieved meaningful participation.

We know that's the bar we have to jump over at the end of the day, and ought to, for this treaty to be ratified.

I would urge you to invite someone from the State Department to discuss our diplomatic initiatives in greater detail and what their interpretation would be of meaningful participation.

Ms. TUBBS JONES. I yield to my colleague, Mr. Chairman.

Chairman TALENT. Yes.

Ms. MILLENDER-MCDONALD. Good morning, Dr. Yellen.

I first would like to speak to the Chair because, as it appears, our colleague had raised many scientific questions to you. And it appears that there needs to be a scientific expert who comes to this Committee to answer those questions, as opposed to posing those questions to you and you do not have the answers.

It appears as if that is an indication that—and it seems to me that those are questions that are posed primarily to embarrass, if nothing else, in my opinion.

And so, I do feel, Mr. Chairman, that if we're talking about scientific questions being raised, we certainly should have the proper people being in this Committee to do so.

Dr. Yellen, you say that you're trying to draw developing countries into this Kyoto Protocol. And yet, they are saying that they will not come in because of new commitments or they have been excluded with—let's see if I can get you that so that I can adequately state that.

They feel that they have been clearly excluded from new commitments in this protocol.

So how do you expect to draw them in if, in fact, they feel that they have not been brought to the table with certain commitments that should be within this agreement?

Dr. YELLEN. First of all, we have a Clean Development Mechanism that is part of the protocol.

I think the Clean Development Mechanism offers clear advantages in meeting the goals of the protocol and benefits for developing countries.

So one of the first things we need to do is to convince developing countries of the benefits to them of using this as a way to put in place environmentally friendly energy-efficient projects in countries that are growing rapidly.

And we're doing that.

Beyond that, I think we can try to convince them, and we are, of the benefits to them of taking on targets voluntarily, in spite of the fact that they're not obliged to do so under the terms of the treaty.

And the reason that I think we have a chance in convincing them is because there is a win-win here.

There is a potential win for developing countries because if they take on targets that represent reductions from their baseline emissions paths, but ones that are not excessively ambitious given their economic situations, they will have the ability to reduce emissions more than they're required to do so.

They have the potential to do that at very low cost and they can earn income as well as resources for their development of their energy sectors by selling emissions permits in the world markets to the United States and other developed countries.

Ms. MILLENDER-MCDONALD. And has this been articulated to them?

Dr. YELLEN. Yes, indeed, it has been articulated.

Ms. MILLENDER-MCDONALD. And what has been the response that they've given?

Dr. YELLEN. I personally articulated this case in several instances in China and in other countries.

I think that this is something that they are beginning to understand, that they can participate in ways that will be a win for them.

And we're pursuing this diplomatically. There is a case to be made.

On top of that, if you take a country like China and ask, what is its number-one environmental problem, I think the answer is air pollution.

So they themselves are tremendously concerned about the adverse health consequences of their intensive reliance on coal. They see themselves developing rapidly with worse pollution, local pollution problems.

That isn't greenhouse gases. That's not climate change. But they have a motive to try to deal with coal and substitute cleaner energy in their own development. Even forgetting about greenhouse gases and climate change.

When you combine their natural interest in controlling pollution with the possibility that they can abate emissions very cheaply, and particularly with the help of U.S. businesses that have the technology readily available to abate emissions of these countries at low cost, and then walk out ahead, having actually earned revenue because by abating emissions below their targets, they can sell these permits in world markets.

We come out ahead. They come out ahead.

Ms. MILLENDER-MCDONALD. Well, truly. But are you suggesting, then, that the U.S. businesses are amenable to doing this with developing countries such as China?

Dr. YELLEN. They would love to do it with countries like China because I think they can see in Chinese participation or other developing country participation enormous gains for businesses.

Businesses would have the opportunity to put into place at low cost technologies we already possess that would enable China to grow in a cleaner way.

And it would boost their sales. It would give a boost to an important industry in the United States, namely, energy efficiency, the whole energy-efficient sector.

It's terrific as a business opportunity and it's a win-win all around.

Ms. MILLENDER-MCDONALD. Well, you see it as a win-win. But do our U.S. businesses see it as a win-win for them, both here, domestically, as well as internationally?

You're saying they do internationally. What about domestically?

Dr. YELLEN. I think even domestically, many of our businesses see the potential for a win here because we will be stimulating the development of new technologies and new cars and fuel-efficient cars and green technologies and environmentally-sound technologies.

And that can be a real win for businesses.

Ms. MILLENDER-MCDONALD. I am just absolutely excited about this issue.

Mr. Chairman, I know I'm over time. I've seen the red light two minutes ago.

But I would like for us to maybe, if I can suggest to you, Mr. Chairman, the Ranking Member, to have another hearing on this, but to bring some of the scientific people out because I would like to pose some questions myself to ones who perhaps have a more scientific view of this issue than perhaps the Doctor has.

And thank you so much.

Chairman TALENT. I appreciate the gentlelady's comments.

We had an extensive hearing on the science in the middle of last year.

I don't generally restrict what members wish to ask about. Dr. Yellen testified as to the scientific underpinnings of this. And so, I thought it was fair for Mr. Hill to ask his questions, although I was thinking while he was doing it that we ought to have a hearing with the Subcommittee on Rural Enterprises.

I'm very interested in reconvening this with Dr. Yellen again and perhaps somebody from the State Department, to find out, among other things, what analyses were made before they agreed to a seven-percent level below 1990 emissions.

Because it does seem to me that this whole international trading system depends on the assumption that foreign countries are able to achieve their targeted emission levels much cheaper than we're able to achieve our targeted emission levels.

Otherwise, they can't reduce the cost of our permits by close to 90 percent, which means that they got a pretty good deal in terms of their targeted emission levels.

One question I have is why we didn't get our target emission levels up a little bit, set at the 1990 levels the President originally suggested.

Then maybe we could push them a little bit in negotiations to agree to a little bit less. Because I'm less concerned about win-win for them than I am about the effect on the American economy.

We seem to be very concerned about win-win for foreign countries and less concerned about the impact on our own country.

I'm also going to inquire, Dr. Yellen, about what analysis you did perform before—and we'll get through this in written questions—before Kyoto.

Let me ask you one other question. I know you have to go.

What are we going to do if the other countries agree to targeted emission levels and then they cheat?

Dr. YELLEN. Compliance and monitoring is clearly a very important issue in the design of an emissions trading system, and it will be considered in great detail in that context.

Chairman TALENT. I understand. But I mean, since we are considering—Mexico agrees to targeted emission levels, and then says it's doing below that, sells the permits to us, gets all our money and then builds whatever factories it wants.

Dr. YELLEN. There are a number of possible approaches to provide incentives for compliance that, to trade, the countries would have to comply.

That will be the matter that's up for negotiation at the next conference.

Ms. MILLENDER-MCDONALD. And will there be penalties for those who do not comply?

Dr. YELLEN. Well, I don't want to pre-judge what's going to come out of that negotiation. That is what's to be decided, what form possible penalties could take. Could they relate to ability to trade?

That's something that needs to be determined.

Ms. MILLENDER-MCDONALD. And are the tax incentives that the President is proposing, will this help our small businesses because I think that is critically an issue for small businesses as they engage in this whole reduction of emissions.

Dr. YELLEN. Well, the President has laid out a series of tax incentives and other climate change initiatives. I think that small businesses certainly have the opportunity to benefit from the tax cuts that the President has proposed in his most recent budget and in last year's budget as well, to put in place energy-efficient technologies.

Ms. MILLENDER-MCDONALD. I would like to, Dr. Yellen, see those specifically and especially for minority businesses.

Thank you, Mr. Chairman.

Chairman TALENT. Yes.

Dr. YELLEN. Thank you.

Chairman TALENT. If we know they're cheating, they'll comply.

Thank you, Dr. Yellen, for coming.

The next witness—we do have another panel, I should have mentioned. Actually, another witness.

And Mr. Reinstein is not under a time constraint that I know of, so——

Mr. Reinstein, I understand you don't have to go back to Helsinki for a week. So you have plenty of time here for us.

Mr. REINSTEIN. I have lots of time.

Chairman TALENT. We'll go right to your testimony. It's Mr. Robert Reinstein, who is the president of Reinstein & Associates International, Inc.

Mr. Reinstein.

STATEMENT OF ROBERT A. REINSTEIN, PRESIDENT, REINSTEIN & ASSOCIATES INTERNATIONAL, INC.

Mr. REINSTEIN. Thank you, Mr. Chairman. I will try and very briefly summarize the main points of my written statement.

This is a very, very complex issue. The science is extremely complex. I think we touched on some points this morning. But there are many factors affecting the global climate—thousands, probably—of which human emissions are only one. And in particular, contrary to some impressions, no individual weather event can be attributed to human greenhouse gas emissions.

The economic impacts of this issue are also extremely complex.

One of the key factors, and I have highlighted it in my written remarks, is the rate of turn-over of capital stock. It has been said that carbon dioxide is the principal greenhouse gas and the overwhelming source of carbon dioxide is the burning of fossil fuels.

That is primarily in four sectors. And in the United States, these four sectors account for emissions roughly as follows—electric utilities, about 40 percent of our CO_2, transport sector, about 30 percent, manufacturing sector, about 20 percent, and buildings, heating and cooling and so forth, about 10 percent.

An average power plant lasts 30 to 50 years.

We're keeping our cars in some cases up to eight or 10 years. Trucks and buses hang around for 15 or 20 years. Airplanes—some of those 727s are 25 years old.

Manufacturing facilities last from ten to 30 years on average. Particularly the largest, most energy-intensive ones, the world-scale steel and chemical plants, these are investments in the neighborhood of 30 years.

Buildings last typically 50 to 80 years, maybe. Some a lot longer, some less.

So we think of what is required in terms of the turn-over of the capital stock. The average lifetime of the capital stock that is emitting carbon dioxide is much longer than the timeframe of the Kyoto Protocol. So we have a problem here.

In light of these and some other factors, I have done some analysis on the outlook for emissions in all Annex B countries, the industrialized countries, under two different scenarios, and I have described these briefly in my statement.

And what I conclude, based on analysis by gas, by sector, and in the case of carbon dioxide, by fuel source, is that most Annex B countries other than those in central and eastern Europe will not be able to meet their Kyoto targets through domestic measures alone, limited essentially by economic and political feasibility of measures.

There are technical capabilities, but they take you beyond the economic and political threshold, what I call the pain threshold.

I have looked at what you would get if you went across all Annex B countries and were allowed to trade among Annex B, how much supply might be available from those countries whose economies are in transition—Russia and Ukraine in particular—and how much might be needed by the OECD countries—the United States, Canada, Japan and so forth.

And by my estimates, the demand for credits among the industrialized countries is in the range of about 1.7 to about 3 billion metric tons of carbon dioxide equivalent per year.

And the supply from the non-OECD countries—Russia, Ukraine, and the others—is perhaps in the range of 250 million to about 1.3 billion metric tons of CO_2 equivalent.

That leaves the buyers far short of what they need.

The only other source of credits is the project-based flexibility mechanisms—joint implementation and the clean development mechanism. They've been discussed earlier today, and they are discussed in my written testimony and attachments to it.

There are inherent limits in getting credits through projects. You have to organize projects. There are guidelines that are still not agreed internationally on what will be credited from projects.

And the volume of projects that would be required to produce the kind of supply of credits that the emission outlook suggests is huge. If we take the projects that have been done in the 1990s and reported to the UN Secretariat under the "activities implemented jointly" program, these projects, excluding the forestry projects, for which there are no agreed rules yet, contribute about 3½ million metric tons a year in total, about 43,000 metric tons per project.

If that were any kind of an indication of what you could get out of projects, and we look at the OECD demand for credits, it would require between 40,000 and 70,000 projects at that rate to cover the deficit that the OECD countries fall short of their Kyoto targets.

I conclude from that and a number of other factors that the Kyoto Protocol targets are unrealistic and unachievable and that, as a result, a number of countries will probably hold back from ratification and the Kyoto Protocol, as originally agreed, will probably never enter into force.

And I have made some suggestions in my testimony for some elements that might be included in a renegotiation to bring the Kyoto Protocol to a point where it could be ratified by important countries.

In the interest of time, I think you all have the testimony and it is available here.

I will just stop there and go on to some questions.

[Mr. Reinstein's statement may be found in the appendix.]

Chairman TALENT. Okay. What's your estimate about whether— give me the numbers—about whether the amount of credits available will be adequate to meet the demand?

What percentage of the total demand do you think will actually be available?

Mr. REINSTEIN. What would actually be available?

That's a judgment call. I would say that the range of the two scenarios that I have for demand is between 1.7 and about 3 billion metric tons.

My guess is, on the trends we're on, we're going to wind up somewhere at about 2.2 to 2.5 billion metric tons, somewhere in that range is the likely demand. The 1.7 billion metric tons is a best-case.

In terms of supply, I believe the supply of credits is probably not going to exceed about 500 million, maybe 600 million metric tons. And this is from all sources, all three flexibility mechanisms.

So—

Chairman TALENT. 30 percent of the demand.

Mr. REINSTEIN. Yes. The likely supply falls seriously short of the likely demand for credits.

So, in theory, and you can run computer models, if you had China and India and all these countries supplying credits in massive quantities, you might be able to get the costs of complying with the Kyoto Protocol down to the kind of numbers the Administration is putting on the table.

I'm afraid that some of the assumptions that underlie those numbers are not realistic.

Chairman TALENT. You say in your testimony, I would estimate the likely price of emission credits in a real international market, if one should ever come into being before the year 2010, at somewhere between $150 and $200 per ton of carbon equivalent.

Is that correct?

Mr. REINSTEIN. That's what I say in there. And that is a judgment.

I have done energy analysis for about 25 years. And this, in essence, is energy analysis. It's analysis of where you might be able to save energy and generate a credit or also, political judgment as to how many credits countries are likely to make available in a market.

I do not believe all the so-called "hot air," the excess emission allowances in eastern Europe, will be fully available on a world market.

At this point, people don't know how big that supply might be and countries there are likely to keep some portion of it at home if they sell it at all.

Chairman TALENT. So your estimate is about ten times the Administration's estimate.

I'll tell you, Mr. Reinstein, I'm kind of inclined to credit you. And you know why? Because you actually have estimates for supply and demand.

Now how is it that you're able to have estimates for supply and demand and you're a very able person with, I'm sure, a very accomplished firm. And the government of the United States is not able to have estimates for supply and demand.

I could ask that of Dr. Yellen.

Mr. REINSTEIN. Well, I would say that the government of the United States probably does have estimates of supply and demand.

My estimates of the emissions outlook for the Annex B countries are generally in line with estimates that have been done by others, publicly.

Every industrialized country is to provide to the UN Secretariat for the Convention projections of their emissions to 2010.

Most of these countries have done so. These were published in UN documents made available at the fourth meeting of the Conference of the Parties in Buenos Aires.

You can take those numbers and add them up. You get the same result.

You can take the projections of the International Energy Agency in Paris and add them up.

I'm sure the Energy Information Administration of the Department of Energy has numbers. You can add them up.

All these numbers are in the same ballpark. My numbers are right in the ballpark with everybody else's.

And when you add them up, that's what you get for supply and demand.

Chairman TALENT. Could you perhaps explain—and I confronted Dr. Yellen with this—how the Council on Economic Advisors could have told the Committee the following: The Administration has no estimates of the demand for emission credits by year for the period 2008–2012. Demand will be sensitive to a variety of factors that are quite difficult to forecast 10 to 14 years in advance, especially the rate of technological innovation and the diffusion and adoption of current innovations and those placed on the market over the next ten years for the same reason we have no estimates of the supply of emission credits.

Could you explain how they could have said that if you can understand this as an economist, and how they could have come up with the range of a price between $14 and $23 per ton, without some estimates of supply and demand?

Because my understanding, with my rudimentary knowledge of economics, is that the supply curve goes one way and the demand curve goes another way. And where they intersect is where you come up with a price.

And if you don't have a supply curve and a demand curve, you can't get a price.

Mr. REINSTEIN. That's a fairly reasonable assumption, Mr. Chairman.

As she said, and I heard her answer, there are obviously numbers in the models. And when the model results come out, if you pull out the parts of the model output, you should be able to have those numbers.

But it is true. Those are computer-generated things that lack the judgment of experience on whether those numbers are realistic.

However, there are projections for emissions for each country. And those projections, which are public, give you the supply and demand.

That is, if you have an estimate for how much our emissions are likely to be under different scenarios in 2010, and you know our Kyoto target, you simply take the difference and that difference is our demand for credits from outside the United States.

And you can do this for each country that you can project their emissions.

And we have emissions projections for all Annex B countries.

They are difficult for Russia and Ukraine. I agree. Those are exceptionally difficult. And I have been working on mine and revising them constantly because they are difficult.

But I have a fair degree of confidence in the numbers that are in this paper and in the attachments to my statement.

Chairman TALENT. Will the European Union countries on net be selling—well, first of all, let me ask you this question.

Is it likely that the United States is ever going to sell credits to anybody under the protocol?

Mr. REINSTEIN. Well, in terms of likely, I don't believe it's likely that the United States will ratify the protocol.

Chairman TALENT. All right. Assuming it were ratified.

Mr. REINSTEIN. But if we were to ratify the protocol, we have some opportunities for reducing emissions beyond what I would call the pain threshold, that is, what we would be willing to do on our own. But the cost of reducing emissions in Japan, for example, may be so much greater even than our pain threshold, that they would come and say, we'll pay you to do things you wouldn't be willing to do on your own. It's so painful to us, we're willing to pay and reduce these emissions in the United States.

So it could happen that we actually sold a credit.

Chairman TALENT. So some country may have agreed to targets that were even harder for them than our targets are for us?

Mr. REINSTEIN. Some countries may have done so.

Chairman TALENT. Are there any other countries or group of countries where we might be a net seller?

Mr. REINSTEIN. Japan might be an example.

Chairman TALENT. Japan. What about the European Union countries?

Mr. REINSTEIN. The European Union is in a better situation, primarily because of the very significant reductions in Germany resulting from the reunification of East and West Germany, and also reductions in the United Kingdom from the switch from coal to gas in the electricity sector.

However, by my estimate, even in the best case, they still fall short, primarily because Germany falls short of the 21 percent reduction that it committed to under the burden-sharing in Europe.

Chairman TALENT. You know what I'm going to do before I get caught at this. I'm going to—because you can stick around. So I'm going to recognize the Ranking Member and then Ms. Tubbs-Jones who stuck around. And then I'll have some more questions for you.

But in case they wish to leave, I'll recognize the gentlelady from New York.

Ms. VELAZQUEZ. Thank you, Mr. Chairman. I don't think it's fair that Mr. Reinstein is here answering questions or criticizing or analyzing or making opinions on the testimony of Dr. Yellen, and we don't have anybody here from the Administration.

I think it could have been more productive if he's here sitting in this panel and we have someone from the Administration sitting there, reacting to whatever he's saying.

Chairman TALENT. If the gentlelady will yield for a second for a response to that.

I did everything possible to have Dr. Yellen here as long as possible.

The Administration witnesses always want to go first. I tried when I became Chairman to have a rule where they would go afterwards for precisely that reason. And they all have been offended by the prospect of having to wait around for other people to testify.

And since that is universally the protocol everywhere, I finally gave up and allowed them to testify first.

I am happy to—in fact, I am planning to reconvene. I'm sure that Dr. Yellen will be happy to respond to what Mr. Reinstein has said.

Ms. VELAZQUEZ. And I guess we should have someone from her camp who could also provide information that is scientific because it was clearly stated here that she was unable to provide certain information. And she made it very clear.

She is not in a position to offer those informations. That doesn't mean that they don't have the information. It means that the person who is the appropriate person to provide that information is not here.

Chairman TALENT. As rarely as the gentlelady and I disagree, she testified extensively about the scientific assumptions behind this.

I was not—I'll say on Mr. Hill's behalf, I don't think it was wrong of him to go into science, given the fact that she went into science to justify this.

Now I will agree with you that she is not a scientific expert.

I've tried to set these hearings up so we have economics at one time and science at another time because I think they present two different questions.

I went into this very, very dubious about the science. And after the hearing we had, I saw the other case a little bit better.

I'm still dubious, but much clearer in my judgment about that case than I am about the economics.

But I'm happy—the gentlelady knows I do try and work with her. I did go on a long time in my questions with Dr. Yellen.

But I set this up on the assumption that she could stay. So that wasn't my fault. And I'm happy to answer the gentlelady's question. I'm more than happy to have a hearing where we make the science available. Or perhaps we could have a subcommittee hearing so that only those who are interested in it could go to that subcommittee and get that testimony.

Ms. VELAZQUEZ. Well, thank you.

Chairman TALENT. I'm happy to yield to you.

Ms. VELAZQUEZ. And now, Mr. Reinstein, I understand that over the past two decades, we have experienced an average of 1.5 percent greater energy efficiency each year.

We held a hearing last year and some of the panelists that provided testimony provided this type of information.

I'm asking you, if this trend continued over the next 12 years, wouldn't we achieve nearly all of the reduction needed under the protocol?

Mr. REINSTEIN. I'm not sure what you mean by energy efficiency.

If you mean energy intensity as the overall input of energy per unit of GDP output, that's a rather high number. That's a higher number than I have seen for the improvement in energy intensity.

That's the usual measure. That is the GDP energy input ratio. In fact, between 1970 and 1990——

Ms. VELAZQUEZ. So, Mr. Reinstein, you see how different people here come and provide different information.

Mr. REINSTEIN. Yes. I'd be happy to follow up. But my simple answer is, no, I do not think we can achieve the target by a simple, natural, and automatic improvement in energy efficiency, the so-called AEEI—autonomous energy efficiency improvement.

Ms. VELAZQUEZ. Mr. Reinstein, are you familiar with EPA's energy star and green lights programs?

Mr. REINSTEIN. Yes, I am.

Ms. VELAZQUEZ. And what they have done?

Mr. REINSTEIN. Yes, I am.

Ms. VELAZQUEZ. Is it likely that the companies taking advantage of these programs are unique in one way or another, or would it be possible that similar savings could be achieved throughout the economy?

Mr. REINSTEIN. I think this kind of savings is possible. We can extend this. And in my trend scenario, I assume that we continue to find other examples.

That is, I call it trend rather than business as usual because I include things beyond current programs that I assume we will come up with over the next ten years.

Ms. VELAZQUEZ. Has there been any effort to extrapolate these savings and emission cuts to the economy as a whole if similar programs were to be undertaken on a broad scale?

And if so, what do such extrapolations show in the Kyoto context, if you know?

If not, do you think a study of this kind would be warranted?

Mr. REINSTEIN. I don't think you can extrapolate.

First of all, these are unique situations, dealing with building lighting or computer efficiency, the energy star program and things like this.

You can find individual opportunities like this. But to say that you could generalize it to all aspects of the economy I think is going beyond what is a reasonable assumption.

Ms. VELAZQUEZ. Do you know how much of our energy needs are met with foreign oil supplies now?

Mr. REINSTEIN. Oil supply? We're up close to half of our oil from imported oil.

Oil overall is—I'd have to look at my numbers. I don't have them handy. But it's very important because it is the only fuel for transportation. And transportation, obviously, is a very big chunk of energy consumption.

Ms. VELAZQUEZ. How does that compare with the percentages during the oil crisis during the '70s, and when we faced threats from Iraq at the time of the Desert Storm?

Mr. REINSTEIN. I would say today, there has been a significant shift in U.S. energy use towards natural gas, for one thing. We were almost prohibiting natural gas use during the late '70s. We were forcing utilities to convert from gas and oil to coal.

So there has been a significant shift back from coal towards gas in particular.

And there has been a significant shift from direct use of energy—oil and gas—towards electricity. For example, for home heating, and in industry as well. There's been a general, very significant shift to electricity, which is the fastest-growing form of energy.

But that is derivative.

So then you have to go back and look at where the electric utilities get their energy. And there, coal continues to supply about 60 percent of the power generation in the United States.

Ms. VELAZQUEZ. Should international security considerations like Desert Storm or the crisis in the '70s, be included in a cost analysis of something like the Kyoto Proposal?

Mr. REINSTEIN. In theory. In practice, it's very difficult to quantify a benefit because you would have to hypothesize an interruption and you would have to hypothesize the economic impact of this hypothetical interruption.

It is in theory do-able, but very difficult to do.

I believe it is in our economic and security interest to have greater energy efficiency. I have been a strong supporter.

I was at the Department of Energy in the '70s. I was at the Federal Energy Administration, which preceded the Department of Energy before the Department of Energy was created.

So I've been a strong supporter for 25 years of energy efficiency. And I think there are multiple benefits. We should pursue a number of things.

They will not, however, get us to the Kyoto targets.

Ms. VELAZQUEZ. Thank you, Mr. Chairman.

Chairman TALENT. I'll recognize Ms. Tubbs-Jones for questions.

Ms. TUBBS JONES. Thank you, Mr. Chairman.

Mr. Reinstein, I'm a new member of Congress. This is my first hearing with regard to the Kyoto treaty.

What I'm trying to understand is what is Reinstein & Associates?

Mr. REINSTEIN. It's a consulting firm. It's a small business, in fact. It's very appropriate that I'm before this Committee.

Ms. TUBBS JONES. But that's not why you're here to testify because you're a small business.

Mr. REINSTEIN. No.

Ms. TUBBS JONES. You're here to testify to the issues of the Kyoto treaty.

Right?

Mr. REINSTEIN. That's correct.

Ms. TUBBS JONES. Okay. Just so we're clear on where we're going.

How long has Reinstein & Associates been in business?

Mr. REINSTEIN. Three years.

Ms. TUBBS JONES. And prior to the three years, what were you doing?

Mr. REINSTEIN. I was a consultant for three years before that.

Prior to that, I was deputy——

Ms. TUBBS JONES. You were doing consulting three years before that for whom?

Mr. REINSTEIN. I consulted for a number of people. But I have not represented anybody.

That is, consulting can be many different things. I provide analysis, assessments and, on occasion, advice to a wide range of——

Ms. TUBBS JONES. Name five clients for me.

Mr. REINSTEIN. Five clients. The Edison Electric Institute.

Ms. TUBBS JONES. Okay.

Mr. REINSTEIN. The Dow Chemical Company.

Ms. TUBBS JONES. Okay.

Mr. REINSTEIN. The Ford Motor Company.

Ms. TUBBS JONES. Okay.

Mr. REINSTEIN. The Canadian Electricity Association.

Ms. TUBBS JONES. Okay. One more.

Mr. REINSTEIN. The Electric Utilities of Japan.

Ms. TUBBS JONES. Have you ever testified on behalf of the United States?

Mr. REINSTEIN. I have never testified on behalf of anybody, except the United States Government.

Ms. TUBBS JONES. Okay. So, then, you've done this consulting, but never been required to publicly give testimony with regard to the product of your work.

Mr. REINSTEIN. Since leaving government, this is the first time I've testified in six years. So this is the first time I've testified since leaving government.

Ms. TUBBS JONES. Okay. And the five people that you just, five companies, five or six——

Mr. REINSTEIN. Entities.

Ms. TUBBS JONES. Entities, companies, entities.

Mr. REINSTEIN. That's just an example.

Ms. TUBBS JONES. We won't mince words on it, Mr. Reinstein. And let me ask the questions, okay?

Thank you.

The six years you've been consulting for them, you've never been required to testify with regard to your work.

Is that fair?

Mr. REINSTEIN. I have not been required to testify for any reason.

Ms. TUBBS JONES. Or asked to present your findings before a committee.

Mr. REINSTEIN. I have not.

Ms. TUBBS JONES. So what was the purpose of your consulting?

Mr. REINSTEIN. To provide them assessments of what was going on internationally, in particular, in negotiations, what I thought would be the likely future course of negotiations, what——

Ms. TUBBS JONES. Hold on for a second. What do you mean, what was going on, internationally?

Mr. REINSTEIN. There has been an international process in the climate change issue going on since 1988, frankly. It's when the IPCC was created.

I had been part of that process almost from the beginning.

Ms. TUBBS JONES. In what capacity, sir?

Mr. REINSTEIN. As a member of U.S. delegations, as head of U.S. delegation, as chairman of the UN Inter-Governmental Panel on Climate Change working group on responses to climate change.

And since leaving government, as a nongovernment observer to the international——

Ms. TUBBS JONES. When did you leave government, sir?

Mr. REINSTEIN. I left government in April, 1993.

Ms. TUBBS JONES. And what were you doing at that time?

Mr. REINSTEIN. Prior to leaving government?

Ms. TUBBS JONES. No. When you left government, what were you doing?

What was your position at the time that you left?

Mr. REINSTEIN. You mean what position did I leave or what position did I take?

At the time I left, I was in transition.

Ms. TUBBS JONES. What was your position with government when you left, sir?

Mr. REINSTEIN. My position with government, I was Deputy Assistant Secretary of State for Environment, Health, and Natural Resources.

Ms. TUBBS JONES. And what was your responsibility?

Mr. REINSTEIN. My responsibility was overseeing all international activity for the United States in those areas.

Ms. TUBBS JONES. And why did you leave?

Mr. REINSTEIN. I left because during that brief period prior to my leaving, I had the category that I served at the pleasure of the Secretary of State and the President.

They decided that they no longer needed my services, so they asked me to leave.

But I had been in government——

Ms. TUBBS JONES. And so that's why you sit here today so critical of government, isn't it?

Mr. REINSTEIN. No, that is not why I sit here today.

Ms. TUBBS JONES. I have no further questions.

Mr. REINSTEIN. Mr. Chairman, may I have permission to respond to that?

Chairman TALENT. Yes. I'll certainly let the gentleman respond.

I give great leeway to members to ask questions. I will say that Mr. Reinstein's biography, his curriculum vitae, is available. In fact, it's included as part of his statement.

I will read some of his qualifications to testify and then you may certainly finish and make any other comments you may wish, Mr. Reinstein.

He was the Deputy Assistant Secretary for Environment, Health and Natural Resources, 1990 through 1993.

He was responsible for coordinating U.S. international environmental and health policy, including international aspects of such issues as global climate change, ozone layer protection, acid rain, hazardous chemicals, hazardous wastes, endangered species, forests and other conservation issues, biotechnology, AIDS, and other health issues.

He was the chief U.S. negotiator for UN negotiations on a Framework Convention on Climate Change—I can't read that date—1990.

Chief U.S. negotiator for Copenhagen Amendment to the Montreal Protocol on substances that deplete the stratospheric ozone layer.

And his vitae goes on for a long time after that. And you certainly may have the opportunity to make any other comments you may wish to make.

Mr. REINSTEIN. Thank you. If I could respond to the gentlelady, I served at the request of the President and the White House, for a brief period at State Department.

However, I was not a Republican. And I was asked to serve in that capacity because of my professional background, not because of any political affiliation.

I served for nearly 20 years in government, under five different presidents. And during my entire government career, I tried to bring the best analysis to policy-making that I could.

I worked in three distinct fields.

The reason I am here today, and I have been quiet for 5½ years after leaving government, is that I feel that the policy that was adopted and exemplified in the Kyoto Protocol is a mistake.

I think they made a mistake in Kyoto——

Ms. TUBBS JONES. The government didn't force you to be quiet, however.

Chairman TALENT. I will say to the gentlelady, he's responding to my questions. And while I'm——

Ms. TUBBS JONES. But Mr. Chairman——

Chairman TALENT. The gentlelady will suspend. The gentleman is responding to my questions.

Ms. TUBBS JONES. Then have him direct his remarks to you.

Chairman TALENT. The gentlelady will suspend. He's responding to my questions.

I certainly—if the gentlelady would like an opportunity to ask further questions, I will consider that.

I'm not as strict regarding the regular order as some chairmen are. But the gentlelady should ask for permission and ask me to yield——

Ms. TUBBS JONES. Mr. Chairman, I would ask you to yield just to have him direct his comments to you since those are your questions versus directing them to me.

Chairman TALENT. All right. I will yield for the gentlelady's comment.

The Chair does not exercise or administer the Rules of the Committee in an attempt to cut off any debate or any legitimate point that's made, and all members are aware of that.

I did not restrict the gentlelady's questions, which were strong. This is an important issue.

However, I do also allow witnesses, when their credibility, or attempts have been made to impeach their credibility, to respond. I've done that for witnesses on both sides and in response to questions from both sides.

So I am going to permit this Witness to respond. I would caution the Witness, of course, that his remarks should be made in response to my questions.

But you're fully entitled to present any comments you may wish to make about your background or your reason for testifying here.

Mr. REINSTEIN. Thank you, Mr. Chairman.

As I understand it, the question was why I chose to come and make my views available to the Congress at this time.

And the reason is that I believe that I have experience and insights into this issue which would be important and valuable for good public policy-making.

That is why I came forward. I came forward in my personal capacity, representing no one, to provide views based on a number of years, decades of experience that I thought would be useful in the formulation of good public policy.

That is the only reason I came forward.

Chairman TALENT. I'd be happy to recognize the gentlelady from New York.

Ms. VELAZQUEZ. Mr. Reinstein, you mentioned some clients that you have and that you have been working for.

I just have one question and a final question.

How do those companies or clients will be impacted if the Kyoto agreement is ratified?

Mr. REINSTEIN. I would be happy to provide the Committee with a list of my past and present clients. They will be impacted in many different ways.

And in fact, my clients also include people other than companies. They include, for example, the World Bank. They have included the United Nations Environment Program. And they've included environment ministries of some of the governments in Europe.

So the impacts on them will be difficult to judge.

But I can provide a list of my past and present clients and you can see the diversity of that group.

Chairman TALENT. Well, if Dr. Yellen is right, it will be win-win for everybody.

Mr. REINSTEIN. Let's hope so.

Chairman TALENT. And the businesses of the country will just love it.

I have a few more questions and I appreciate your patience, Mr. Reinstein.

Discuss the situation that you anticipate in Russia. Will Russia be a big producer of credits if this protocol were ratified?

If so, why? If not, why not?

Mr. REINSTEIN. I think Russia has significant potential for credits for trading. And that is because of the very poor state of their economy and the fact that their target was set at 1990 levels.

They will do very well, very well, indeed, if their emissions are back up to 1990 levels by 2010.

I think they will not be. They will be still quite significantly below 1990, if anything like the current trends continue.

Whether they would sell all of the difference between their likely emission levels in 2010 and their Kyoto target to the United States or anybody else is a different question.

And there, I'm not so sanguine that they will simply transfer for whatever price the total difference between their actual emissions and their Kyoto target to the United States or anyone else.

The question also came up as to how do we verify and track whatever is sold—who sells it, where does the money go?

Those are some very big questions.

In order to be able to engage in a program where Russia would make very significant emission rights available to the United States, they would obviously have to organize a whole program, identify projects, if it's project-based, and what not.

They're having some very serious difficulties organizing their economy these days. I think they will have very serious difficulty organizing this kind of effort as well.

So I see a much more modest supply out of Russia potentially than a lot of analysts. But it is for reasons having to do with the internal difficulties that they're having, not just the fact that they're short of their emissions target.

Chairman TALENT. One concern I had was the possibility of some kind of cartel or something developing with regard to these credits.

Now, on the one hand, it would clearly be in the interest of countries that have a lot of these credits to try and artificially raise the price through some kind of monopoly or cartel.

On the other hand, I am a believer that those things are hard to sustain against—if there is a truly functioning kind of free market.

And you look at OPEC, for example, which has been successful in raising prices above the market level. But that's continually breaking down and it's difficult for them to sustain.

Would you give me your opinion on that? Do you think that under this kind of a trading regimen, it would be likely that we'd have some kind of a cartel designed to raise prices above a pure-market level?

Mr. REINSTEIN. I'm not clear that we would have a cartel.

I think, obviously, sellers would try to extract the maximum rent, the maximum economic benefit they could get from their credits.

That is why I conclude that credit prices will be much higher. That is to say, people will not sell at cost, but will sell for what they think they can get from a market where, by my estimate, demand far exceeds supply.

Chairman TALENT. And the demand would be inelastic, would it not, since it's required by the law?

Mr. REINSTEIN. If in fact a country has ratified, it is legally required to meet its target. And if it has to buy credits from outside or take very painful domestic measures, its demand is fairly inelastic. And that will tend to drive the price up.

Chairman TALENT. You probably disagree with this because you sound like you're a lot less of a populist than I am. But it just seems to me that we probably comply—if past precedent is any history, we'd comply.

Mr. REINSTEIN. Yes.

Chairman TALENT. And I bet we'd be strict as all get out. If somebody tried to open up—my brother tried to add a few tables to his tavern and ended up using a little more electricity, they'd come down on him like a ton of bricks. But the rest of the world might not comply so well.

That's one of the concerns I have with this.

Mr. REINSTEIN. I think the United States has a very good record of compliance with those treaties it has ratified, and that is the way we approach the ratification process.

Compliance in other parts of the world, indeed, on average, is not as good as it is here in the United States. There is a danger that compliance would not be as effective in all other countries that we compete with economically.

Chairman TALENT. It would be worth a lot of money to them because the ideal scenario would be to fudge the numbers so that you could expand pretty much what you want at the same time as you're selling credits to the richest country in the world for permission for it to expand its economy.

Not only are you getting the immediate transfer of the cash, but you're making our economy less competitive and our goods less competitive on the world market.

Mr. REINSTEIN. That is a risk. That's a very real risk.

Chairman TALENT. All right. That's all I have. I notice a couple of people—I'm sorry. The gentlelady? Go right ahead.

Ms. VELAZQUEZ. I have a question. Mr. Reinstein, do you know if anyone has done any study or analysis about how much of American corporations who have relocated to developing countries, how much of the greenhouse gas problem they have contributed?

Mr. REINSTEIN. There have been studies on the shift of particularly basic manufacturing from the U.S. and other industrialized countries into developing countries.

The reasons for these shifts are very complex. Sometimes they have to do with availability of raw materials where the deposits of those raw materials in the United States and Canada, for example, have become depleted and there's a richer deposit in the developing country.

Sometimes they have gone for tax reasons.

They may have gone where people have set environmental standards, the so-called pollution havens.

I don't think—I have never seen a good study that is able to separate that factor out from all of the other economic or fiscal taxation factors that, in combination cause relocation, I have never seen a good analysis that is able to isolate that factor from all the other factors that may cause a company to relocate.

It's very difficult. It sounds simple, but it's actually very difficult to analyze.

Ms. VELAZQUEZ. But it would be very interesting to know how much of the greenhouse gas problem has been caused by American corporations in those developing countries.

Chairman TALENT. There were, it looks like to me, a couple people who stayed from Dr. Yellen's staff. And the Ranking Member made the point that there was no opportunity to respond.

I don't know if you wish to offer any comments for the record, anybody who stayed from Dr. Yellen's staff.

Ms. ANDERSON. Not at this time.

Chairman TALENT. Okay. I wanted to give you that opportunity if you wished.

Ms. TUBBS JONES. Mr. Chairman?

Chairman TALENT. Yes, I recognize the gentlelady.

Ms. TUBBS JONES. I'd like to thank Mr. Reinstein for his testimony.

Chairman TALENT. I thank the gentlelady for her comments. And I would, also, and we appreciate your coming here. We didn't keep you the whole week you're going to be in the United States, anyway.

Thank you, Mr. Reinstein.

Mr. REINSTEIN. Thank you very much. It was a pleasure to come here, and I'd be happy to come back.

Thank you.

Chairman TALENT. Without objection, we'll keep the record open for ten additional days to submit further questions.

The Committee is adjourned.

[Whereupon, at 11:40 a.m., the hearing was adjourned.]

STATEMENT OF CHAIRMAN JAMES M. TALENT

Good Morning. Today, the Committee on Small Business will examine the Kyoto Protocol's impact on the United States economy. Specifically, I want to focus on the Administration's July 1998 economic analysis, a document released after June 4, 1998, when Dr. Janet Yellen first testified about the Protocol in front of this Committee.

The Kyoto Protocol requires the United States to reduce its greenhouse gas emissions 7% below its 1990 levels by 2012. Historically, there is a direct correlation between increases in greenhouse gas emissions, energy use and gross domestic product. Increased domestic production, in most cases, creates more jobs and permits more Americans to participate in the American dream of small entrepreneurship. Nevertheless, the Administration's analysis suggests we can reduce greenhouse gas emissions with minimal economic impact, including no aggregate loss of jobs.

Although the United States signed the Kyoto Protocol last November, the Administration's policy relies on future negotiations for an unlimited international trading system that includes "meaningful participation from key developing countries." Dr. Yellen attempts to justify the Administration's policies by predicting that through the trading system the United States can reduce carbon dioxide permit price 93% from domestic actions alone.

Dr. Yellen previously suggested China, India, South Korea and Mexico are among "key developing countries." The Administration's analysis assumes these countries' "meaningful participation" requires an agreement to accept emissions target that are "equal to . . . business as usual emissions levels in 2010." this means that while the U.S. is required to reduce its greenhouse gases by 7% below 1990 levels, these countries can participate in the Kyoto Protocol by emitting the same amount of greenhouse gases as they would emit absent the Kyoto Protocol.

This policy hinders American corporation's domestic expansion, encourage domestic downsizing and promotes corporate relocation abroad. The Administration's analysis permits an American company to produce carbon dioxide emissions at a business as usual pace in countries such as Mexico, earn "credits" by cutting American jobs and cash in the credits at the expense of American businesses that decide to expand or remain status quo domestically

Nevertheless, developing countries refuse to publicly discuss the adoption of emission limits. At the latest Council of Parties meeting in Buenos Aires, a group of developing countries removed the issue from the agenda. The Indian Ambassador echoed these sentiments in a letter to my office.

With or without developing country participation, the Protocol is bad for American business, especially small businesses whose minimal capital turnover and exponential expansion dreams depend on affordable and abundant energy. These kinds of concerns are the reason I maintain the Kyoto Protocol sells out American jobs, American enterprise and American prosperity.

We have two witnesses who will appear before the Committee today, including Dr. Janet Yellen. Before we turn to those witnesses, I will recognize the distinguished ranking member for any statement she may wish to make.

STATEMENT OF HON. CAROLYN MCCARTHY

Thank you Mr. Chairman, and Congresswoman Velázquez, for scheduling this hearing to obtain a better understanding of the economic impacts the Kyoto Protocol will have on small businesses.

Small business owners throughout my district have expressed concern over the economic as well as labor implications this protocol will have on them. A major concern involves the difference between actual costs. It is my understanding that numerous studies have been prepared by private firms as well as the Clinton Administration that predict these cost. They range from costing an American household $2,700 a year to $112 per family per year. This is quite a cost disparity.

Another concern involves possible loss of American jobs if underdeveloped countries are not held by the same pollution reduction standards as developed countries. An estimate by the Wharton Econometrics Forecasting Association, Inc., predicted that 2 million jobs would be lost if emissions fall 7% below the 1990 levels. This is unacceptable. Although I am supportive of the reduction in greenhouse gases, I believe that *all* countries should make an attempt to remedy this problem. This is not just an American problem or European problem, it is a global problem. If undeveloped countries are allowed to produce as many greenhouse gases as they wish, we are ignoring the main objective of the Kyoto Protocol which aims to improve the environment.

If businesses within developed countries are forced to abide by emission levels stated in the protocol, it seems to me that they would take their business, as well as jobs, to a country that does not fall under the protocol. We have already seen this occur with the quest for cheap labor. Many times the quest for a profit overshadows adequate wages and environmental protection.

I support the Administration's attempt to include undeveloped countries in the Kyoto Protocol. However, I would like to see any confusion surrounding the exact cost of this protocol clarified.

Thank you Mr. Chairman.

TESTIMONY OF DR. JANET YELLEN, CHAIR, COUNCIL OF ECONOMIC ADVISERS

Thank you, Mr. Chairman. I appreciate having this opportunity to discuss with you the economics of climate change and the Administration's efforts to address this significant environmental challenge. As you know, the Administration released a report last July, entitled "The Kyoto Protocol and the President's Policies to Address Climate Change: Administration Economic Analysis." The report states that, in the Administration's view, the costs of achieving our Kyoto target would be modest if we can succeed in implementing international trading, joint implementation, and the Clean Development Mechanism in an efficient manner and we achieve meaningful developing country participation. In addition, since the 1997 Kyoto Conference, a variety of research of the economics of Kyoto, and especially on the economics of Kyoto's flexibility mechanisms, has been undertaken. Today, I will provide a brief summary of the Administration's Economic Analysis and review several of the key findings in the recent economic literature on climate change.

THE POTENTIAL IMPACT OF CLIMATE CHANGE

The Intergovernmental Panel on Climate Change (IPCC) concluded in 1995 that "the balance of evidence suggests that there is a discernible human influence on global climate." Current concentrations of greenhouse gases have reached levels well above those of preindustrial times. If growth in global emissions continues unabated, the atmospheric concentration of carbon dioxide (CO_2) will likely double relative to its preindustrial level by midway through the next century and continue to rise thereafter. As a result of the increased concentration of CO_2, the IPCC estimates that global temperatures will increase by between 2 to 6 degrees Fahrenheit in the next 100 years, with a best guess of about 3.5 degrees Fahrenheit. Potential consequences associated with this shift in climate include a rise in sea levels, greater frequency of severe weather events, shifts in agricultural growing conditions from changing weather patterns, threats to human health from increased range and incidence of diseases, changes in availability of freshwater supplies, and damage to ecosystems and biodiversity. Further discussion of the costs of climate change is contained in the Administration Economic Analysis.[1]

THE KYOTO PROTOCOL AND THE BUENOS AIRES CONFERENCE OF THE PARTIES

The Kyoto Protocol provides several mechanisms that would allow countries to achieve the emissions targets established in this agreement in a cost-effective fashion. These mechanisms, which permit what we have termed "when", "what", and "where" flexibility in meeting the Kyoto emissions targets, are described in detail in the Administration Economic Analysis. Since securing international emissions trading, the Clean Development Mechanism, and joint implementation in Kyoto, the Administration has worked in bilateral and multilateral areas to promote understanding of these mechanisms and to develop rules that will promote their efficient operation. Last fall in Buenos Aires, a workplan to resolve key implementation issue regarding these mechanisms by the end of 2000 was agreed to by all the participating countries. I want to reiterate that efficient implementation of these flexibility mechanisms is critical to reducing the costs of achieving the targets established in the Kyoto Protocol.

COSTS OF ACTION

In assessing the economic effects of the Kyoto Protocol, the Administration has drawn on the insights of a wide range of models and analysis. Examples include models of the energy sector and economy over the next 25 years, such as those participating in the Stanford Energy Modeling Forum, the Intergovernmental Panel on Climate Change's review of the economic and social dimensions of climate change, the work of the Organisation for Economic Co-operation and Development (OECD) on the economic dimensions and policy responses to global warming, and the Administration's staff-level interagency analysis. In addition, the Administration used other tools, such as a meta-analysis, basic economic reasoning, overviews of the domestic and international energy sectors, statistics regarding energy efficiency and greenhouse gas emissions, and economic indicators from World Bank, International Energy Agency, and Energy Information Administration databases.

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[1] Please refer to the attached paper copy or http://www.whitehouse.gov/WH/New/html/kyoto.pdf for a PDF version of this document.

Assuming that effective mechanisms for international trading, joint implementation, and the Clean Development Mechanism are established, and assuming also that the United States achieves meaningful participation by key developing countries, the Administration's overall assessment is that the economic cost of attaining the targets and timetables specified in the Kyoto Protocol will be modest for the United States in aggregate and for typical households. This conclusion is not entirely dependent upon, but is fully consistent with, formal model results. The Administration believes that there are limitations to relying on any single model to assess the economic impact of the Kyoto Protocol. However, model results can further inform and improve the understanding of the effects of climate change policy. To complement the economic analysis of the Administration's policy to address climate change, we have conducted an illustrative assessment with a modified version of the Second Generation Model (SGM). The results from the SGM substantiate the conclusion that the economic effects of an efficient, effective, and global policy to address the risks of climate change will be modest.

An assessment using the SGM model that accounts for effective trading and developing country participation yields permit price estimates ranging between $14/ton and $23/ton, and direct resource to the U.S. between $7 billion and $12 billion/year (1997 dollars). The range reflects uncertainty about the extent of Annex I participation in international trading.

Under the assumptions of the Administration's analysis, permit prices in the range of $14/ton to $23/ton translate into energy price increases at the household level between 3 and 5%. Under these permit prices, fuel oil prices would increase about 5 to 9 percent, natural gas prices about 3 to 5 percent, gasoline prices about 3 to 4 percent (or around 4 to 6 cents per gallon), and electricity prices about 3 to 4 percent. This increase in energy prices at the household level would raise the average household's energy bill in ten years by between $70 and $110 per year, although such predictions may not be observable because they would be small relative to typical energy price changes, and nearly fully offset by electricity price declines from Federal electricity restructuring. By 2008–2012, the anticipated 10 percent decline in electricity prices from restructuring is projected to lead to expenditure reductions of about $90 per year for the average household.

The illustrative modeling analysis does not account for several key components of the Kyoto Protocol and the Administration's policies to reduce greenhouse gas emissions. These include the benefits of reducing net emissions through cargon sinks, the Administration's electricity restructuring proposal, the Administration's Climate Change Technology Initiative (increases in R&D funding and new tax incentives in the Administration's FY 2000 Budget), the Administration's sectoral consultations to encourage and support voluntary efforts by U.S. industry to undertake emissions reductions, including the provision of credit for early action, and the Administration's efforts to reduce federal energy use. There are also ancillary benefits of reducing greenhouse gas emissions—in particular, the corresponding reductions in conventional air pollutants like sulfur dioxide and fine particular matter. These benefits along could produce savings equal to about a quarter of the costs of meeting our Kyoto target.

The Administration released earlier this month its proposed electricity restructuring legislation. The Administration's proposed Comprehensive Electricity Competition Act (CECA) is estimated to reduce greenhouse gas emissions by about 40 to 60 million metric tons of carbon equivalent per year by 2010. Further, the electricity restructuring proposal provides potential cost-savings in four areas: dispatch efficiency, improved capital utilization, savings in capital additions and cost reductions in fuel procurement, non-fuel operation and maintenance expenses, and administrative and general expenses. These four categories of savings, when translated to consumers, are likely to reach or exceed $20 billion annually. The Department of Energy is revising its technical analysis of last year's proposal to reflect changes in the latest proposed legislation and will release the new analysis to the public in the near future.

RECENT RESEARCH ON THE ECONOMICS OF CLIMATE CHANGE

Since December 1997, many economists have conducted and made available their analyses of the Kyoto Protocol. I have noted in previous appearances before Congressional Committees that there are limitations to relying on one or a small set of models and that we were eager to see assessments of the Kyoto Protocol by other models. Two large efforts have been undertaken to coordinate and compile modeling results on the Kyoto Protocol. First, the Stanford University Energy Modeling Forum (EMF), a long-running model comparison exercise involving many of the leading climate and energy models, has coordinated full scale analyses of the Kyoto Protocol. Second, the Organization for Economic Co-operation and Development (OECD) held an economic modeling workshop this past fall, and has since published the proceedings of this workshop which includes 16 papers. In addition, several research teams have undertaken work in evaluating the potential for intergas trading and the cost-savings of a six-gas target relative to a carbon dioxide-only target. I would like to take this opportunity to provide an overview of this recent research.

Kyoto Modeling Analyses

The final results of the Energy Modeling Forum comparison exercise of the Kyoto Protocol reflect the work of twelve modeling teams from the United States, Europe, and Asia.[2] In evaluating the Kyoto Protocol, all of the participating teams used economic models that incorporate the potential for international trading in greenhouse gas permits. The OECD workshop included presentations by 10 modeling teams, 9 of which had global models as well.[3] [4] By explicitly incorporating international trading, these models can evaluate the opportunities for cost-savings through trading among Annex I nations and among Annex I and developing countries were they to adopt emissions targets. Since the Kyoto Protocol enables all countries with emissions targets to trade emissions allowances among other countries with targets, these models are well-suited to assess the economic implications of the international trading component of the agreement.

While the models used in the EMF exercise and the OECD workshop can assess international trading, there are several other flexibility mechanisms of the Kyoto Protocol that they cannot, at present, readily assess. For example, these models did not incorporate the effects of sinks. While several modelers did assess the economic costs of achieving the Kyoto targets with "off-line" assumptions about sink activity, none incorporated an integrated energy-land use model. Further, most of the modelers did not evaluate opportunities to reduce costs by trading across greenhouse gases. These models are primarily energy models and are focused on the economics of reducing carbon emissions from fossil fuel combustion. Again, some modelers analyzed the Protocol by making some "off-line" assumptions about the potential reductions in non-carbon dioxide greenhouse gases, but none employed a model with cost curves for these gases. Finally, it should be noted that these models did not include opportunities for emissions reduction through Administration proposals, such as electricity restructuring or the Climate Change Technology Initiative, that could slow the growth over time of greenhouse gas emissions thereby lowering greenhouse gas permit prices.

The results from both the EMF and OECD efforts provide very useful context for the Administration's economic analysis. First, the illustrative model used by the Administration, the Second Generation Model of the Pacific Northwest National Laboratory, tends to fall in the middle of the range of this set of models in terms of U.S. permit prices.[5] For example, under Annex I trading SGM generates a permit price which is above the median of this set of models, while under full global trading, the SGM permit price is just below the median permit price. Second, the EMF exercise found that the reduction in permit prices as trading expands from no trading to Annex I trading to full global trading is robust. On average, the EMF models found that Annex I trading would cut the U.S. permit price by 60% relative to a no trading scenario. Of these models, one estimated a 77% reduction in the permit price under Annex I trading. In full global trading, the permit price would be, on average, 81% lower than the no trading price. Several models estimated permit price reductions of about 90%.

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[2] The results of the Stanford Energy Modeling Forum's Kyoto Protocol exercise will be published in a forthcoming issue of the Energy Journal.

[3] Please note that several modeling teams participating in the EMF exercise made presentations at the OECD workshop.

[4] PDF-formatted files of the OECD workshop proceedings can be downloaded from the OECD webpage at http://www.oecd.org//dev/news/Environment/Modeling.htm.

[5] Please note that the version of SGM used in EMF differs from the analysis conducted by the Administration because the EMF version does not include cost curves for non-carbon dioxide greenhouse gases used by the Administration. Since efficient trading across gases would lower costs and permit prices, and accounting for six gases affects the stringency of some countries' targets, the EMF version of SGM yields slightly higher permit prices than the Administration version.

The reported results from the OECD workshop found similar reductions in permit prices by going from no trading to Annex I trading. On average, the OECD workshop models found that Annex I trading would cut the U.S. permit price by 57% relative to a no trading scenario. Moreover, they found that the European Union and Japan would benefit more from unconstrained Annex I trading. For both the E.U. and Japan, the average reduction in permit prices across these models would be nearly 75%.

Analyses of trading constraints

In addition to the modeling of various efficient international trading scenarios, several EMF modeling teams have considered the impact of constraints on the opportunity to buy or sell emissions allowances in an international market. While the United States is unambiguously opposed to trading restrictions, several parties to the agreement have indicated support for some form of a trading constraint, for example, by setting a limit on the amount a party can purchase through the trading system. Trading restrictions would generate no benefit for the global climate while they could significantly increase the costs of achieving the Kyoto targets.

Before describing the economic costs of trading constraints, I would like to explain why such constraints yield no climate benefits. Regardless of where a greenhouse gas emission reduction occurs, it has the same effect on total emissions and the same effect on the climate. A ton reduced in New York generates the same climate benefit as a ton reduced in Berlin. In proposing trading constraints, some have focused on countries such as Russia, that will have emissions below their Kyoto targets during the commitment period because of the decline in their economic output associated with the transition to market economies. If trading constraints are established that restrict the ability of Russia to sell permits (or restrict the opportunity for other Annex I countries to buy Russian permits), then emissions during the first commitment period would be lower than in the absence of such constraints. However, Russia would simply bank its allowances and use these allowances in a subsequent commitment period when its emissions exceed its target. While a trading constraint might lower emissions during the first commitment period, the cumulative emissions over several commitment periods from Annex I countries would be the same with and without the trading constraint. Given the long residence of times of greenhouse gases (on the order of a 100 or more years), the cumulative effect is what is most relevant in terms of changes in the global climate.

To provide a sense of the economic implications of trading constraints, I would like to share with you two examples from work done by EMF modeling teams. First, consider a trading constraint that mandates that at least two-thirds of the emissions reductions necessary for a country to achieve its Kyoto target must occur through domestic actions. Evaluating this trading constraint with the EPPA model based at the Massachusetts Institute of Technology, the permit price for the United States is almost four times higher with the constraint than under an unconstrained global trading system. It is important to note that the effects of this constraint are even more pronounced for the European Union and for Japan. The permit price for the EU would be more than five times higher than the unconstrained global trading permit price, and the Japanese permit price would be thirteen times higher. As these results indicate, the trading constraint would result in each country experiencing a different marginal cost of abatement, and there would be no common permit price for a ton of carbon equivalent. Since the constraint restricts opportunities for countries like the United States, Japan, and members of the EU to buy emissions allowances, the competitive price for emission allowances from countries like Russia would fall below the unconstrained level.

Second, consider a trading constraint that mandates that acquisitions of permits through international trading could not exceed 10% of a country's emissions allocation. For example, the U.S. target is approximately 1.5 billion tons of carbon equivalent on an annualized basis. Under this trading constraint, the United States, or private firms in the United States, could not purchase more than 150 million tons on an annual basis from other countries. Assessing this trading constraint with the Second Generation Model, the permit price for the United States would more than triple relative to the unconstrained global trading permit price. For the E.U., the permit price would nearly double, and for Japan, the permit would be eleven times as high as the unconstrained global price.

While trading constraints increase greenhouse gas permit prices (and subsequently, energy prices) in the United States, the European Union, and Japan, they also reduce the gains from trade by the countries likely to be sellers of emissions allowances. For example, Russia and large developing countries that adopt emissions growth targets and participate in international trading, e.g., China and India, would sell fewer emissions allowances at lower international permit prices under such trading constraints than in an unconstrained global trading environment. Such restrictions lessen the benefits of participation by developing countries in international trading.

Estimated reduction in costs from trading across gases

As we note in the Administration Economic Analysis, the Kyoto Protocol provides additional flexibility in achieving emissions targets by specifying these targets as a basket of 6 types of greenhouse gases (carbon dioxide, methane, nitrogen dioxide, hydrofluorocarbons, perfluorocarbons, and sulfur hexafluoride). Countries can effectively trade across gases, based on their global warming potential, so that the aggregate weighted emissions reductions occur at least cost. Most models used to evaluate the Kyoto Protocol have not incorporated this kind of flexibility, although several modeling teams are actively working to modify their models to include emissions of non-CO_2 greenhouse gases. In the Administration's analysis, cost curves for these other gases for the United States were used in conjunction with the SGM model. These simulations suggest that trading across greenhouse gases can lower costs up to 15% relative to a situation where no trading across gases occurs.

Complementing this finding, recent work by a group of researchers at the Massachusetts Institute of Technology has found that including the opportunity to abate non-CO_2 greenhouse gas emissions and promote carbon sinks reduces the costs to the United States by about 25% relative to a carbon-only approach (assuming no international trading). On average, they find that Annex I countries' costs would fall by more than 20%. In addition, work by University of Illinois researchers and others has evaluated the changes in costs of abating methane and carbon dioxide to achieve the U.S. Kyoto target instead of abating carbon dioxide alone. They found that meeting an emissions target through cost-effective trading between carbon dioxide and methane reductions could reduce costs by nearly 20% relative to a case with no intergas trading. Finally, research by several Dutch analysts presented at the OECD workshop found significant opportunities for the European Union to substitute abatement of non-CO_2 greenhouse gas emissions for carbon dioxide reductions. They found that 27% of the total reduction effort necessary for E.U. countries to achieve their emissions targets could occur through the abatement of these non-carbon dioxide gases.

Developing country participation

Last year during the Buenos Aires Conference, two non-Annex I countries, Argentina and Kazakstan stated that they will announce emissions targets and expressed their interest in engaging in international emissions trading. We believe that these two countries' efforts may encourage other non-Annex I countries to follow their lead. Economic and environmental benefits could accrue to developing countries if they adopt binding emissions targets and participate in international trading. Setting a target below the business as usual emissions level for the commitment period would generate climate benefits by reducing global emissions below what they would otherwise have been. In addition, if the target is set not too far below the business as usual emissions level, the participation of the country in a global trading system would produce economic benefits or "gains from trade" for both the developing country and its trading partners. Emissions trading by developing countries would occur only if they chose to undertake emissions reductions above and beyond their commitments—reductions that would generate trading extra income for them as long as their marginal abatement cost is below the world trading price for greenhouse gas permits. Many of the EMF models reveal that, for large developing countries, like China, such excess reductions would indeed by profitable, so that these countries would export allowances and gain from trade. Developing countries would also reap ancillary benefits of reducing conventional air pollutants, which may be substantial. Benefits from trading would also accrue to Annex I countries. Annex I countries (and private firms in these countries), who would purchase these emissions allowances in the world market, would achieve their targets at lower costs than without the participation of the developing countries. However, it should be noted that the more stringent the target for the developing country, the lower the gains from trade both for that country and for Annex I countries such as the United States. Indeed, an extremely stringent target could conceivably make the developing country a net importer of emissions allowances, and raise the international trading price for a greenhouse gas permit. Still, these models illustrate the potential to create targets that simultaneously make the environment, the developing country, and Annex I countries all better off.

CONCLUSION

The Administration's overall conclusion is that the economic impact of the Protocol will be modest under the conditions we have identified in our economic analysis. The purpose of this testimony has been to summarize the analysis we have presented in the Administration Economic Analysis on climate change and to provide a brief update of recent research efforts outside of the government.

I look forward to continuing to work with members of this Committee, as well as with other interested parties, in further analyzing the Kyoto Protocol and evaluating the net effects of reducing greenhouse gas emissions. It is my hope that economic analysis will continue to play a key role in designing policies in this area.

I welcome your questions.

STATEMENT OF ROBERT A. REINSTEIN, PRESIDENT, REINSTEIN & ASSOCIATES INTERNATIONAL, INC.

Mr. Chairman, Members of the Committee, I'm pleased to appear before you today to share some of my views on the Kyoto Protocol to the UN Framework Convention on Climate Change (FCCC). The text of the Protocol was adopted in Kyoto in December 1997 but still has not been ratified by the United States or any other industrialized country of any significance. There are good reasons for this reluctance to ratify, as I will indicate only briefly in my remarks here.

I have also made some materials available to the Committee that go into greater detail on several points that I will touch on here. Copies of these are attached to my statement, and I would ask with your permission that they be made part of the record of this hearing.

THE SCIENCE OF CLIMATE CHANGE AND APPROPRIATE RESPONSES

First, let me make a brief comment on the science of climate change. Several years ago I characterized the debate over the science as the debate of the birds: Chicken Little vs. the Ostrich. Some were and still remain convinced that terrible things will happen because of human greenhouse gas emissions and that immediate draconian actions are justified to avoid these catastrophes. Others argue that we know very little about climate change, which might even be a benefit to the earth, and therefore that nothing is justified at this stage.

The truth lies between these two extremes. This is a long-term issue. There are reasons to be concerned about an unlimited increase in GHG concentrations in the atmosphere, and I believe an appropriate response to it over the longer term is clearly justified. Many of the longer-term actions to limit emissions are also fully justified from the point of view of energy security, international competitiveness and other priorities as we prepare ourselves for the increasingly interdependent and technologically oriented world of the 21st Century.

However, these actions should not be taken precipitously, without a proper understanding of both their effectiveness across a broad range of policy objectives and their impact on different sectors of the economy and different regions of the country and the world.

I have made some further comments regarding the science of climate change and its possible impacts in connection with the plenary session of the UN Intergovernmental Panel on Climate Change that took place in Vienna, Austria, last September. They are provided to the Committee as Attachment 1 to my statement.

FEASIBILITY AND IMPACTS OF THE KYOTO TARGETS

In my view, the situation described above calls for some actions on the part of governments. I think most of us want to do the "right thing" in regard to the global environment.

But is the Kyoto Protocol the "right thing"? It is an appropriate response to the longer-term increase in human-related greenhouse gases in the atmosphere? I do not believe that it is, for a number of reasons.

The primary reason is that the emission limitation and reduction targets agreed to in Kyoto are simply too much and too soon for most industrialized countries listed in Annex B of the Protocol. Only the countries with economies still in the early to middle stages of transition from centrally planned to market-based and a few others are likely to meet these targets, and all of them for reasons other than actions taken to address climate change.

Russia, Ukraine, and several other small countries will meet their Kyoto targets because their economies have declined significantly and are not likely to recover by the first commitment period of the Protocol from 2008 to 2012. Germany will achieve emission levels by 2010 that are below 1990 levels because of the large reductions in the former East Germany as a result of closing many inefficient energy-intensive facilities. The United Kingdom will achieve lower emission levels because it restructured its electricity sector and allowed utilities to purchase cheaper, cleaner, lower-carbon natural gas instead of more expensive coal that results in more than 60% higher CO_2 emissions than natural gas. Luxembourg will reduce emissions by closing its old, inefficient steel mill.

ROLE OF CAPITAL STOCK TURNOVER

However, none of these countries will have lowered its emissions by taking actions for climate-change reasons that were not otherwise justified either for political or economic reasons. In particular, none of them are replacing capital stock prematurely for climate reasons. This is an important point, because it is the capital stock lifetimes and turnover rates that constrain more than any other factor what kind of emission limitation can be achieved in a given time frame without very high economic costs.

Consider the typical average lifetimes of most of the capital stock that is associated with emissions of CO_2 the principal human-related greenhouse gas. These emissions come mostly from four sectors of the economy: transport, manufacturing industries, electric power generation and buildings.

People are now tending to keep their cars for up to 10 years or more. Trucks and buses are used for longer, perhaps 15 or 20 years, airplanes for 20 or 25 years, and ships for even longer. Manufacturing plants last from 10 to 30 years, with the largest facilities (steel mills, chemical plants, etc.) at the high end of this range. Power plants are used from 30 to 50 years. Buildings usually last 50 to 80 years (some less but others even longer).

With capital stock turnover rates reflecting these lifetimes, it is impossible for me to see how most countries can meet their Kyoto targets in the very short time frame that begins in only 8 years and 8 months. Some incentives could be provided to accelerate somewhat the turnover of capital stock, but this would result in only a marginal impact relative to the inertia of most of our infrastructure and equipment. And it is not guaranteed that the replacement will necessarily result in significantly lower greenhouse emissions, since business and consumer choices are influenced by many factors other than climate-change concerns.

OUTLOOK FOR EMISSIONS AND THE KYOTO FLEXIBILITY MECHANISMS

To get a clearer picture of the impact of the Kyoto targets on individual countries, I have developed projections of emissions of each Annex B (industrialized) country for 2010 under two different scenarios. These estimates, which are described more fully in Attachment 2 to my statement, cover each of the greenhouse gases controlled by the Kyoto protocol and are broken down by sector and, for CO_2 from fuel combustion, also by fuel (i.e., coal, oil and natural gas).

These estimates are generally in line with those done by others, including the US Energy Information Administration, the International Energy Agency in Paris, and even the individual governments themselves, as reported to the secretariat of the UN Framework Convention on Climate Change. Almost everyone's estimates show the same thing: most Annex B countries are not projected to meet their Kyoto targets.

However, the Kyoto Protocol also provides three mechanisms through which countries can obtain credits toward their targets by cooperating with other countries. One of these mechanisms, pushed especially by the United States, is international emission trading, that is, the transfer of emission rights or allowances from one Annex B country to another. The other two mechanisms that provide flexibility in meeting emission targets are related to specific projects on other countries. Joint implementation (JI) of projects by two or more Annex B countries can create emission reduction credits that can be shared among these countries. The Clean Development Mechanism (CDM) encourages projects in developing countries and can generate emission reduction credits for the Annex B donor country.

THE DEMAND FOR EMISSION CREDITS FAR EXCEEDS THE LIKELY SUPPLY

The big question is: can these flexibility mechanisms provide enough credits to allow countries, in particular the US, to meet their Kyoto targets at an acceptable cost? Based on the emissions projections for each country, I have estimated the outlook for credit demand and availability. If a country is projected to exceed its Kyoto target under either of the scenarios, the difference between the projected emission level and the target translates into a demand for credits. If a country's emissions would fall below its Kyoto target (as in Russia and a few other countries), the difference represents a potential supply of emission credits.

The results of this comparison show that the demand for credits among OECED countries ranges from somewhere more than 1.7 billion tonnes of CO_2 equivalent in the most optimistic scenario to almost 3 billion tonnes if current trends continue. The largest part of this is the US shortfall relative to its Kyoto target, which is about 1.2 billion tonnes of CO_2 equivalent in the best case, after every economically and politically feasible domestic measure has already been taken, and is almost 1.8 billion tonnes if current trends continue.

The supply of possible emission credits is less than this demand. The maximum potential supply of credits available through emission trading is less than 1.3 billion tonnes of CO_2 equivalent under scenario where the economies of Russia and other eastern European countries fail to recover from their current problems and continue to stagnate until 2010. This scenario, which would produce barely enough surplus credits to cover the US deficit, if we could somehow obtain all of them, should be a cause of considerable concern to us from other perspectives, such as global economic stability or national security.

Under the scenario where these countries' economies recover, the potential supply of emission credits available for trading is only about 250 million tonnes of CO_2 equivalent. This if far less than the minimum demand by OECD countries for such credits and more than an order of magnitude less than the demand if current trends continue.

For a variety of reasons discussed in the paper attached to my statement, I believe that Russia, the source of most of the credits potentially available through emissions trading, will not actually trade much, if any, of its surplus. The government has already indicated that it prefers the project-based approach, which will attract both investment capital and technology that are sorely needed to help modernize the Russian infrastructure.

The supply of credits from the project-based flexibility mechanisms is inherently much less than trading-based supply. Each project must be organized, certified for that the reductions are additional to those that would have occurred anyway, and meet all the other criteria still to be defined. This means delays in starting and limited volumes of credits once the projects are implemented. A project-based credit supply from the central and eastern European countries (through JI) is probably only about 100 to at most 300 million tonnes, or about 10% of the demand from the OECD countries.

The analysis of potential availability of credits from the flexibility mechanisms must also consider the availability of credits from countries outside Annex B through the Clean Development Mechanism (CDM). These credits will only be from actual projects in these countries, which inherently limits the possible supply. Moreover, credits from each project must be certified in accordance with various guidelines and criteria, as discussed above. Credits from the CDM will be slow in coming not only because of the need to agree on guidelines, etc., but also because of a likely long debate over how the CDM governance is to be structured. A prudent estimate is that 200 to 300 million tonnes would be a likely upper end of the range for CDM credits by 2010.

Overall, I would estimate the likely total supply of emission credits from all three Kyoto flexibility mechanisms at between 200 and 500 million tonnes per year. This implies a very significant number of project sin other countries, perhaps from 3,000 to as many as 10,000 projects, which would represent an amazing achievement in terms of the administrative effort required to organize and approve all these projects. But the resulting best-case credit supply is less than 30% of the minimum demand for credits by OECD countries under the most optimistic scenario, and the low estimate of credit supply is less than 7% of the OECD credit demand if these countries continue their current trends.

THE COST OF EMISSION CREDITS WILL NOT BE CHEAP

Let me say just a few words about the possible cost of credits. I do not believe, as some apparently do, that they will be cheap. Any future international market for emission credits is going to be dominated by the largest buyers (in this case the US) and the largest sellers (most likely Russia, at least in the near term).

In such a situation where the demand for credits far exceeds the supply, the price of such credits is likely to rise to close to the marginal cost of emissions reductions for the largest buyer of credits. Why would Russia, or another country with credits to sell make them available for significantly less than the buyer would otherwise have to pay to achieve the same emission reductions through domestic measures? One may conclude from this that the cost to the US of achieving the Kyoto target with full use of the flexibility mechanisms is likely to be only slightly discounted below the cost that would be incurred without the mechanisms.

One source of confusion is that many economists refer only to the marginal costs of achieving emission reductions in the United States in comparison to these costs in other countries. This assumes the full cost of a project has already been met except for that cost necessary to gain the additional emission reduction. But this may not be a reasonable assumption in a number of these other countries.

For example, the administration has funded and provided technical assistance (from DOE and EPA) in preparing a "Country Study" of Russia and its options for responding to climate change. This study estimates the cost of emissions reductions in the energy sector (where most of the potential exists) at $200 to $300 per tonne of carbon equivalent. But the administration has testified that the cost of emission credits in the international market should be between $14 and $23 per tonne. This is a huge difference.

The difference is due to the difference between full cost and marginal cost. The country study is referring to full cost while the low estimates are only marginal costs. But in Russia and many other countries, unless the full cost of many projects is funded by outside sources, the projects simply will not materialize and the marginal costs of emission reductions will exist only in economic theory. And few sellers in a real market sell at cost anyway. When was the last time any member of this Committee obtained a meal in a Washington restaurant at cost?

For these and other reasons, I would estimate the likely price of emission credits in a real international market, if one should ever come into being before 2010, at somewhere between $150 and $200 per tonne of carbon equivalent (about $40 to $55 per tonne of CO_2).

OUTLOOK FOR RATIFICATION AND ENTRY INTO FORCE OF THE PROTOCOL

Article 25 of the Protocol specifies the conditions for entry into force of the Protocol. The Protocol will enter into force 90 days after at least 55 countries have ratified or acceded to the Protocol, provided that these countries account for at least 55% of the CO_2 emissions in 1990 of the industrialized countries (those listed in Annex I of the UN Framework Convention on Climate Change).

The US accounted for about 35% of Annex I CO_2 emissions in 1990, which alone is not sufficient to block entry into force of the Ky9oto Protocol. However, a number of other countries are very likely to wait until the US ratifies before they do so, particularly countries with strong trade and other economic ties to the US such as Canada and Japan.

The 15 Member State of the European Union must ratify all at the same time as a group because they intend to be treated as a block or "bubble" under the provisions of Article 4. If any Member State ratifies alone, it is subject to the 8% reduction target that is listed for each EU country in Annex B and only a minority of EU countries are likely to be able to reach such a target. This means that if any EU country holds back, then all 15 countries are effectively held back from ratifying, and some EU Member States may wish to wait in order to put pressure on the US.

The likely consequence of this dynamic is that the Kyoto Protocol is unlikely to enter into force for several years. During that time most countries' emissions will have continued to rise in line when current trends. With each passing year not only will their emissions levels be farther above their Kyoto targets, but they will be one year closer to 2008, when the targets become binding. It will become apparent that meeting the targets will be impossible for almost all of them.

This creates a certain dilemma, since the only way to achieve sufficient ratifications to trigger entry into force appears to be a renegotiation of the targets to bring them more in line with reality. But the targets can not be amended except by the Parties to the Protocol after it has entered into force. One way around this dilemma might be negotiation of a separate legal instrument (treaty) that would be ratified together with the Protocol, would enter into force simultaneously with the Protocol, and would modify whatever provisions of the Protocol were necessary in order to allow key countries to ratify.

The new instrument would be negotiated sometime between 2003 and 2006. Its provisions might include:

A realistic set of differential targets for the Annex B countries, much more accurately reflecting national circumstances and what might actually be achieved by each country.

A new first commitment period, say from 2013 to 2017 at the earliest. The original 2008–2012 period would already be too soon to get agreement on targets that reflected any significant change from then current emission trends.

A new base reference period, possibly a multi-year average of 1998–2002, which would be much more realistic than continuing to refer back to 1990 and could also adapt for year-to-year variations due to weather, electricity trade and other factors.

The inclusion in Annex B of some newly industrialized countries such as Korea and Mexico and maybe a few others, provided the targets were set on a reasonable and realistic basis.

The clarification of the rules, guidelines, criteria, etc., for the flexibility mechanisms, and establishment of the governance for the Executive Board of the CDM.

A longer-term collective target for 2025 or later that would send a signal for development of new technologies and would be conditional on evidence that such technologies were actually feasible (technically, economically and politically).

Such an agreement would correct the shortcomings of the Kyoto Protocol and would establish a more reasonable and stable process for responding to global climate change on an international level.

That concludes my statement, Mr. Chairman. I would be happy to try to answer any questions you or any member of the Committee may on any of the points raised in my statement, in any of the attachments, or on any other aspects of the climate change issue where I may be able to contribute to shed some light on various aspects of this complex issue.

Attachments

(1) R.A. Reinstein, "Some Comments and Suggestions on IPCC's Work," prepared for the 14th IPCC Plenary Session, Vienna, September 1998.

(2) R.A. Reinstein, "Kyoto Protocol: Emissions Outlook & Flexibility Mechanisms," based on a paper originally presented to the Electric Utilities and Environment Conference in Tucson, AZ, on 11 January 1999. The estimates of national GHG emissions have subsequently been updated and the tables here reflect those revisions.

(3) R.A. Reinstein, "The Kyoto Protocol and Energy-Intensive Industries," February 1999.

(4) R.A. Reinstein, "Kyoto Goals: The Impossible Dream," in Foreign Service Journal, March 1999.

SOME COMMENTS AND SUGGESTIONS ON IPCC'S WORK

The following comments and suggestions related to IPPC's work are offered in the author's personal capacity and are based on more than ten years' experience with climate change issues, nearly 25 years' experience with economic and energy policy issues, and 40 years' experience with scientific issues.

It is my hope that the experts gathered for the IPCC meetings in Vienna will find them of some use in helping to frame and focus IPCC work over the next few years. The intent of these suggestions is to encourage IPCC results that are credible and useful to a broad audience and to avoid as much as possible confrontational areas where the objectivity and appropriateness of IPCC's work may be questioned.

My principal suggestions for IPCC work, which are discussed in more detail below, include the following:

Distinguish very carefully between "human influence" and causality, especially the (lack of) ability of present science to attribute individual climate events or patterns to anthropogenic emissions.

"Inform" public policy by indicating and quantifying where possible the risks of certain changes and impacts that may be associated with human activity in order to facilitate decision making that ultimately must be left to the public officials responsible for these policies.

In particular, leave to the international process under the Framework Convention the essentially political determination of what constitutes "dangerous anthropogenic interference with the climate system."

Give greater attention to adaptation to climate change, since there will be climate change in any case, in light of the vulnerability of different countries to the impacts of climate change, particularly with regard to their level of economic development.

Identify as much as possible the critical impacts that go beyond the normal ability of people to adapt to climate change regardless of the causes of such change, as well as those affecting vulnerable ecosystems which may be unable to adapt naturally or with human assistance.

Give priority attention to assessing why many "no-regrets" measures have not been able to advance farther and, where possible and appropriate, identify government policy options for facilitating faster implementation of those no-regrets measures that may be currently discouraged as a result of unnecessary, non-economic market barriers.

However, avoid judging any specific measure as “no-regrets” regardless of differences in national circumstances, leaving to each individual government to make the judgment as to what is justified as “no-regrets” in its specific situation.

Continue and extend earlier work on the possible feasibility of various technology options in terms of three types of feasibility: technical, economic and market.

Be very careful to avoid any kind of general and in particular static assessment of the economic feasibility of technological options, but identify as much as possible the factors that influence economic feasibility while leaving the actual feasibility determination to be made by those who must actually make the investments.

Identify where possible not only the feasibility factors themselves for assessing the three types of feasibility but also analytical tools for applying these factors within a specific national situation.

HUMAN INFLUENCE VERSUS CAUSALITY

Recent studies have increasingly revealed the complexity of the global climate system. While models are able to suggest how the system might respond to changes in certain forcing functions, such as anthropogenic GHG emissions, all other things being equal, the fact is that not all other things are equal. Various factors interact with one another in very complex ways not yet fully captured by the models.

It is now known, for example, that on different occasions many centuries prior to the industrial age, the climate system has undergone significant changes in relatively short periods of time as a result of natural forcing factors. We do not yet know why or how this happened. And without knowing why or how, it is extremely difficult for us today to predict with any reasonable certainty what the climate of 20, 50 or 100 years from now is likely to be.

This essential complexity of the system makes it very difficult if not impossible, based on present scientific understanding, to identify specific results that will occur if specific mitigation measures are taken in order to avoid climate change. Any human-induced climate change takes place against a background of natural climate change. This natural climate change will occur in any case, and a degree of human-induced change may also occur because of emissions that have already been released to the atmosphere or that will be released in the coming decades.

However, it is not possible to say today that any particular climate pattern of the present or future has been explicitly caused by human behavior. There is a significant difference between “influence” and “causality.” It may be possible that humans are influencing the climate system. But our current understanding does not allow us to say that humans are causing the climate events, which are due to a very complex mix of factors, many of them natural.

The IPCC, and Working Group I in particular, needs to be very careful in making this distinction. It is an important one, and seems to be not fully appreciated by at least some high-level government policy makers. For the sake of its credibility, the IPCC must make it very clear that taking any particular actions to mitigate climate change, while they may be justified for various reasons, will not mean that humans can through these actions avoid any specific climate events. This would be like King Canute, who tried to order the tides to be held back.

SCIENCE AND PUBLIC POLICY

In light of this near-impossibility of attributing specific climate events and patterns directly to human greenhouse gas emissions, policy makers are faced with a major dilemma. How can a cost benefit analysis be done that will explain to the public what benefits would result from emission limitation measures that may be quite costly?

There are continuing debates about what these costs might be, but there is even more uncertainty about what the benefits might be in terms of avoided climate change. At present, we do not know what climate change may occur from natural causes, we do not know what portion of the observed climate change may be due to human causes, and we can not say that such and such climate events or patterns simply will not occur if these mitigation actions are taken.

Part of the response to this dilemma, for the IPCC, lies in being very clear about the role of science in relation to public policy. Science can and in fact must “inform” public policy. Decision makers need to understand as much as possible what is known, what is presently not known, what may be known in the relatively near future, and what probably can never be known with any degree of certainty.

But “informing” public policy is not the same as “guiding” public policy. The IPCC needs to be very clear that the various assessment and special reports of the Panel can not tell policy makers what they should do. These reports can only facilitate informed decision making. The decisions themselves must be made by the public officials responsible for these policies and not by the scientists and other experts that prepare the IPCC's reports.

The ultimate objective of the Convention, the Kyoto Protocol, and any other legal instruments that may be adopted by the Parties is to achieve "stabilization of greenhouse gas concentrations in the atmosphere at a level that would prevent dangerous anthropogenic interference with the climate system." It should be understood that this objective is basically political.

While science can inform the decision-making process by indicating and quantifying where possible the risks of certain changes and impacts that may be associated with human activity, only politicians can define what is "dangerous." This will depend on the specific circumstances of each country, the level of human influence it may be willing to tolerate in its situation, and its (essentially political) relationships with other countries regarding the impacts on other countries and the global system. The process that continues to evolve under the UN Framework Convention on Climate Change is the appropriate place for these questions to be worked out among different governments.

The question is then: Given the complexity of the climate system and inability to be able to separate the specific effects of human emissions from the broader natural mechanisms that cause climate change, and given the essentially political character of the ultimate objective of the legal instruments that governments have adopted and will adopt to address climate change, what role can science play?

It would seem that science, in particular but not exclusively through the IPCC reports, can inform the decision-makers by identifying the kinds of effects that may occur from human activity and the direction (positive or negative) and approximate magnitude of such effects, and should leave to the politicians decisions as to what kind and degree of precautionary or risk-avoidance measures should be taken in light of this information.

IMPORTANCE OF ADAPTATION

The IPCC needs to give greater attention to adaptation to climate change. We already know that there will be climate change in any case. All countries everywhere in the world must find ways to adapt to this change. This is nothing new. Since the origin of the human race, people have had to adapt to climate change of considerable magnitude, and with far fewer resources than are available to people living today.

Humans have shown a marked ability to adapt to climate change over the centuries, including to ice ages when modern means of protecting against the cold were not available. The IPCC should take note of how adaptation has taken place in the past and how such adaptation measures may serve to adapt to future climate change. One might learn, for example, from the people living along the Bay of Fundy in eastern North America, where the change in sea level every six hours as a result of the tides exceeds 10 meters in many locations. There are many instances of remarkable adaptation shown by people once they understand that adaptation is necessary.

When one speaks of the impacts of climate change, it is important to note that the actual impacts that will occur in any location are net impacts, after adaptation. Since a significant degree of adaptation will occur in any case, as it has over many centuries, the critical impacts that must be identified and addressed are those that go beyond the normal ability of people to adapt to climate change regardless of the causes of such change, as well as those affecting vulnerable ecosystems which may be unable to adapt naturally or with human assistance.

This in turn leads to an examination of the vulnerability of different countries and peoples to a range of possible changes in the climate system. While geographic location and circumstances can clearly be important, as in the case of small islands and low-lying regions, the greatest degree of correlation of vulnerability to climate change impacts is with the level of economic development.

At lower levels of economic development, people are more tied to activities, especially subsistence agriculture, that are specific to a given location. As development proceeds, a greater portion of economic activity is flexible with regard to location, thus reducing the potential vulnerability to sea-level rise, storms and other climate events that may cause adverse impacts.

Similarly, vulnerability to increases in the occurrence of tropical diseases, for example, depends very much on level of economic development and the resulting advancement of health-care systems. There are many countries in the world today with similar climates that might cause vulnerability to the incidence of vector-borne diseases, but these countries differ greatly in the actual occurrence of these diseases because of differences in level of development and health care.

In addition to being necessary because there will be naturally occurring climate change in any case, many adaptation measures are often the least-cost response to climate change for a number of countries. For all of these reasons, the IPCC should give greater attention in its future reports to the full range of measures that countries will need to consider as they adapt to that portion of climate change that cannot be avoided by any reasonable human actions.

In its work on these aspects of climate change, the IPCC should keep clearly in mind both the time frame of impacts and the time frame of adaptation measures. For example, the average lifetime of much of the building stock may be between 50 and 80 years. This means that if major sea-level rise is projected to occur at a given location in roughly this same time frame, the buildings can simply be rebuilt on higher ground as they would normally be replaced, without incurring major economic impacts as a result of this adaptation.

A more complete assessment of adaptation options will be of benefit to most of the world, because all future generations will be faced with climate change from natural causes, and perhaps also human causes, and will therefore be able to make use of this work regardless of the outcome of current debates about the science of anthropogenic climate change.

ASSESSMENT OF "NO-REGRETS" MEASURES

The preceding comments are not meant to suggest that adaptation should be the principal or only response to climate change, but simply that a "balanced portfolio" of response strategies should have a good mix of both adaptation measures and mitigation measures. Many mitigation measures are justified not only for climate change reasons but also for a number of other reasons. Such measures are often referred to as "no-regrets" measures because governments will not regret having taken them even if human-induced climate change turns out not to be a significant threat.

In its earlier work the IPCC has already identified a large number of potentially no-regrets measures. However, many of these, although they have been justified on other grounds such as energy savings for many years now, still have not approached their apparent market potential. The IPCC needs to give priority attention to assessing why such measures have not been adopted already.

There are many possible reasons for the failure of no-regrets measures to reach their potential. In some cases there may be institutional, informational or other barriers to market penetration. In other cases the measures may simply not be economically justified when assessed in terms of real-world market conditions.

For example, combined heat and power (CHP), or cogeneration, is often identified as a no-regrets measure because it can, in principle, result in very significant efficiency gains as compared with the separate production of electricity and heat. However, it requires that there be a relatively need for heat throughout the year, either for industrial processing or for district heating. Thus, it has potential only near power plants where there are industrial facilities not already using the waste steam or where the climate is cold enough to require heating for a significant portion of the year. It would probably not be considered economic to install district heating from CHP in relatively mild climates.

The IPCC should examine the full range of reasons why no-regrets measures have not been able to advance farther and, where possible and appropriate, identify government policy options for facilitating faster implementation of those no-regrets measures that may be currently discouraged as a result of unnecessary, non-economic market barriers.

In this regard, however, it is important to note that the feasibility of any specific emission limitation measure will depend very much on the individual circumstances and conditions in each country and even in different parts of the same country. What may be "no-regrets" in one situation may not be justified at all in a different situation. While identifying potential measures in its work, the IPCC should be very careful to avoid judging any specific measure as "no-regrets" regardless of these differences in circumstances. Each individual government must be left to make the judgment as to what is justified as "no-regrets" in its specific situation.

ASSESSMENT OF TECHNOLOGY OPTIONS

The question of feasibility is obviously broader than simply the assessment of potentially "no-regrets" measures. The IPCC has already attempted to address this broader issue even in its First Assessment Report. Earlier work has, inter alia, examined the possible feasibility of various technology options in terms of three types of feasibility: technical, economic and market. This work needs to be continued and extended.

Even technical feasibility is not universal but may depend on circumstances. For example, solar energy technologies require sunlight and wind technologies require wind, and the relative availability of these inputs of nature is very location-specific. Some technologies may require significant quantities of water, which is not equally available in all locations. These factors need to be very carefully identified and listed for each technology assessed by the IPCC.

Economic feasibility is even more difficult to assess. Not only does it depend on different conditions in different locations, but it varies over time and also depends on the actions of other players in the market. For example, the economic feasibility of fuel switching from coal to natural gas will depend on the relative availability and prices of these two fuels at a particular location. However, both the availability and the price of each fuel will change over time as a result of many market variables, including but not limited to resource depletion, changes in transportation technology and economics, and so forth. And if many other players also decide to switch fuels in the same relative time frame, this will cause the price of gas to rise and the price of coal to fall, thereby altering perhaps significantly the initial assessment of economic feasibility.

In its assessments of economic feasibility, the IPCC needs to be very careful to avoid any kind of general and in particular static assessment of the economic feasibility of technological options. As with technical feasibility, the IPCC assessments should identify as much as possible the factors that influence economic feasibility but leave the actual feasibility determination to be made by those who must actually make the investments.

The most difficult task is assessing market feasibility. This component of feasibility must take into account political factors, public attitudes, consumer preferences, aesthetics, "lifestyle" issues, and many other things that are extremely difficult to assess and often even to identify. Such differences help to explain why a particular technology, such as nuclear power, may be acceptable in one market but not in another, even if the technical and economic feasibility determinations are essentially the same for both markets.

As another example of the importance of assessing market feasibility, US auto manufacturers, at government urging, produced many small cars in the late 1970s, only to find that not enough consumers were willing to buy them, even though they were technically sound and clearly economic in light of the high price of fuel at that time. Subsequent research showed that many factors affected the purchasing decisions of consumers, including performance, safety and transport capacity (for both passengers and baggage), as well as such emotional factors as "image."

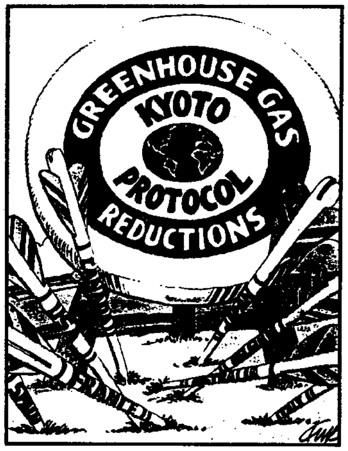
More recently, some wind machines have been rejected by local populations on aesthetic and animal welfare grounds. It has been argued in some of these instances that the new, modern and efficient machines, which have finally improved their economic feasibility, are ugly when deployed in large numbers and destroy too many birds. This illustrates that implementation on a larger scale, while usually improving economic feasibility, may have the opposite result with regard to certain market feasibility factors.

The IPCC will not be able to, and should not attempt to, assess feasibility in specific national situations. Feasibility can not be assessed in the abstract but must be judged in the individual situation. This is the job of national governments and of individual investors.

As with technical and economic feasibility, however, the IPCC can provide important help to governments and others in trying to identify the full range of relevant market feasibility factors that influence the ability of any particular technology to penetrate a given market. Moreover, the IPCC could provide a very important service by identifying not only the feasibility factors themselves but also analytical tools for applying these technical, economic and market feasibility factors within a specific national situation.

It should further be noted that many technologies, including "soft" technologies or techniques, are not proprietary but are already in the public domain. The IPCC can enhance the usefulness of its work by providing important information on such technologies that are already freely available to developing countries and others.

KYOTO GOALS: THE IMPOSSIBLE DREAM



KEN ROBERTS

IT WOULD BE NICE IF DEVELOPED NATIONS COULD MEET THE KYOTO TARGETS, BUT THEY CAN'T AND WON'T.

BY ROBERT A. REINSTEIN

A remarkable change seems to be taking place in the U.S. approach to international negotiations, if the 1997 Kyoto Protocol on climate change is any indication. In the past the United States always took what might be called a "pragmatic" approach: that is, the U.S. did its homework before going into the negotiations. At Kyoto, where the U.S. played a major role in establishing the major features of the agreement, we seem to have "jumped off the cliff" in a leap of faith. The U.S. position was based more on ideology than on a quantitative and qualitative assessment of what its bottom line should be.

As a result, the agreement is deeply flawed. The protocol has the laudable goal of seeking to prevent dangerous human interference with the global climate system by limiting the emissions of heat-trapping gases by industrialized countries. However, it appears that most of these countries will be unable to meet the commitments undertaken in Kyoto.

Instead of helping to solve this important global problem, the Kyoto Protocol will delay progress by having created a treaty regime that effectively prevents key countries from ever ratifying it, and which will therefore never enter into force.

The administration's signing of the Kyoto Protocol raises fundamental questions about the basis of U.S. foreign policy.

What Kyoto Says

In December 1997, most countries of the world adopted the text of the Kyoto Protocol to the U.N. Framework Convention on Climate Change (FCCC). More than 70 countries (including the U.S.) have signed it, indicating their political commitment to seek ratification. Only two countries (Fiji and Tuvalu), however, have thus far actually ratified the protocol.

If ratified by the U.S. Senate, the protocol would require the U.S. to reduce its greenhouse gas emissions that contribute to climate change to 7 percent below their level in 1990 by the first commitment period of 2008-2012. Targets for other industrialized countries (listed in Annex B of the protocol) range from 8 percent below 1990 for the European Union to 10 percent above 1990 for Iceland. Among the industrialized countries covered (this is important) are Russia, Ukraine and several other formerly communist countries whose economies have taken a nosedive since 1990.

The targets cover six human-related greenhouse gases, including emissions from all sources. In principle, the targets should also include the removal of these gases from the atmosphere by "sinks" (such as forests and other vegetation that absorb CO_2 as they grow), but how carbon sinks will be figured in to treaty compliance still must be negotiated.

The states of the European Union will achieve their common target of an 8 percent reduction (or 92 percent of 1990 levels) jointly rather than individually. The protocol requires these countries to agree among themselves on how each individual country will contribute to their common target.

In addition, potential flexibility in meeting national targets is provided in the protocol through three mechanisms that would allow transfers or crediting of emissions reductions achieved in other countries:

1. Direct transfers or "trading" of emissions allowances among the industrialized countries;
2. Joint implementation (JI) of projects in industrialized countries to reduce emissions by these countries; and
3. A Clean Development Mechanism (CDM) for implementing emission-reduction projects in developing countries.

However, the rules, modalities, verification procedures and other aspects of these "flexibility mechanisms" are still to be fully worked out.

The Main Problem

Can the Kyoto targets be met, either through domestic actions alone or in combination with credits obtained through the treaty's flexibility mechanisms?

In this article, I present estimates of the greenhouse gas emissions outlook for the U.S. and other industrialized countries under two different scenarios, and compare those projections with the targets agreed to by these countries in Annex B of the Kyoto Protocol.

The main conclusions drawn from this analysis indicate serious flaws in the protocol:

- The U.S. and most other industrialized countries of the OECD cannot achieve their Kyoto targets through domestic measures alone even under the best-case scenario (that is, all reasonable domestic measures are implemented to limit greenhouse gas emissions).
- The industrialized nations will therefore have demand for credits from the flexibility mechanisms such as international trading to cover the gaps between their emission targets and their actual emissions.
- The potential surplus of emission "credits" that might be available for trading from Russia and other former communist countries will not be enough to fill the gap. While these countries' emissions are likely to be lower than their Kyoto targets in the years 2008-2012, their surplus will be much less than the demand from OECD countries.
- As a result, the cost to the U.S. of meeting its

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Table 1: Possible Demand for Emissions Credits

Country	1990 Actual Emissions	Kyoto Percentage Target	Kyoto Target	2010 Trend Scenario	Resulting Deficit	2010 Pain Scenario	Resulting Deficit
GERMANY	1210	.79	956.0	1157.3	201.4	1048.2	92.3
ITALY	543.2	.935	507.9	593.6	85.7	568.8	60.9
BRITAIN	751.5	.875	657.6	737.6	80.0	665.4	7.9
EU -15 (SUB-TOTAL)	4235.2	.92	3896.4	4455.1	558.7	4110.0	213.6
JAPAN	1301.2	.94	1223.1	1529.9	306.7	1369.1	145.9
U.S.	5858.5	.93	5448.4	7207.3	1758.8	6636.0	1187.6
OECD TOTAL	13,363.9	.934	12,480.3	15,448.0	2967.7	14,228.0	1748.5

This table projects possible demand for emissions credits (in million tons CO_2 equivalent) under the Kyoto Protocol flexibility mechanisms. Note that there are two possible deficits (that is, demand levels) given for each country. First, under the trend scenario (business as usual) given by the author, each country has a deficit between expected emissions and its Kyoto target. Under the "pain" scenario, countries make all possible efforts to reduce emissions, so the deficit is smaller. Source: Reinstein & Associates International.

Kyoto target, assuming unrestricted use of the flexibility mechanisms, will be quite high — almost as high as the cost of meeting its target without any flexibility mechanisms (contrary to assertions by senior administration officials).

The fact that the U.S. agreed to such a result in Kyoto in December 1997, and further indicated its political commitment to seek eventual ratification by signing the protocol in November 1998, raises some very fundamental questions about the basis for U.S. foreign policy in this area and its future direction.

Scenarios for 2010

On the basis of a detailed analysis of the situation of each industrialized country, estimates have been developed for emissions of each greenhouse gas covered by the Kyoto Protocol. In order to provide a broader perspective, two different scenarios for 2010 (the midpoint of the first Kyoto commitment period) were examined:

The Trend Scenario: Current trends continue, including additional reasonable measures that can be justified as well for other reasons, according to national political factors (call that "continued good efforts");

The Pain Threshold Scenario: All reasonable economically and politically feasible measures are taken to limit emissions (what might be called "true best efforts").

As with any scenarios for possible future conditions, these are not predictions but rather are projections of what might occur given certain policy approaches by different countries. They frame the likely range of results for each country.

The Trend Scenario is similar to what is often referred to as "Business As Usual" (BAU) in many studies. However, it includes the likely effects of a few more additional measures than many BAU scenarios might. In recent years the trend has been for many governments to seek to identify and implement whatever reasonable measures they can that might limit greenhouse gas emissions, as long as these measures are economically justified and provide other benefits as well (such as reduced local air pollution).

Actual emissions would undoubtedly be lower than the Trend Scenario projections if the Kyoto Protocol were to enter into force. But there is a basic limit on what each country can do to limit its emissions through domestic measures. The Pain Threshold Scenario assumes a country does all that it reasonably can to limit emissions, up to the point where further actions would have unacceptable economic and social consequences (job losses, disproportional regional impacts, widespread hardship, etc.). It is assumed that this threshold depends in part on the current understanding of the science of climate change, or at least on public perceptions regarding the risks of climate change and related impacts.

This public perception will necessarily differ from country to country. For example, for some countries (especially in Europe) a very high value is placed on environmental goals and people are willing to make some sacrifices to achieve these goals. In other countries this may be less the case. Regional differences in economic activity, which may constrain a country more than national average conditions might suggest, are another variable. Lifestyles and expectations regarding the levels of certain conveniences and services differ as well. Finally, priorities vary among countries regarding certain industrial activities related to military and security concerns.

It is most unlikely that countries would go beyond the threshold of pain on the basis of computer model projections, coupled with allegations by politicians (but not supported by most scientists) that recent weather events are due to human emissions. Most people were unwilling to make the kind of sacrifices that would be beyond the Pain Threshold even in the 1970s, when there were actual local shortages of energy and a four-fold increase in oil prices.

Both the Trend outlook and the Pain Threshold outlook will undoubtedly change over time. New technologies will emerge and evolve. These will affect the potential to limit emissions in the future, but cannot be anticipated with much certainty. Social and political attitudes will change, and may go in either direction. And further developments in the scientific understanding of possible human-induced climate change will undoubtedly affect popular perceptions, and especially the Pain Threshold outlook.

The scenarios used for the formerly centrally planned economies are somewhat different from the two scenarios described above for OECD countries. The lower number corresponds to a scenario where hardly any improvement occurs in these countries' economic situation by 2010. The high estimate assumes most of these countries have progressed reasonably well along the transition path from centrally planned to market economies by that date.

Unrealistic Targets

During the negotiations that led up to the Kyoto meeting, the United States called for agreement on legally binding emission targets for all industrialized countries. The U.S. said such targets should be "realistic and achievable."

If you look at Table 1, you'll see that's not what happened. The table compares the targets agreed to in Kyoto (expressed as a fraction or multiple of the 1990 base year) with the likely emissions of a number of key OECD countries under the two scenarios described above. It can be seen that for most countries the targets are beyond even the best-case situation of the Pain Threshold Scenario, in which all economically and politically feasible domestic measures have been taken.

The conclusion is unavoidable that the Kyoto targets are unrealistic and unachievable, at least based on domestic measures alone. The U.S. target would imply an additional reduction of 20 percent below its Pain Threshold level in 2010, and of 30 percent or more below the Trend Scenario. The changes in economic activity and lifestyle that would be required to achieve such a result are unprecedented since World War II. Moreover, the impacts of such an effort would differ greatly from one economic sector or region to another. This kind of effort is clearly beyond the limits of political feasibility.

The Supply/Demand Problem

As mentioned above, the Kyoto Protocol allows industrialized countries that cannot meet their targets through domestic actions alone to use flexibility mechanisms, such as international trading of emissions credits or implementation of projects in other countries. Assuming the parties to the treaty ever agree on the rules and guidelines for the flexibility mechanisms, the question is whether these mechanisms can enable the Annex B countries to meet their Kyoto targets. The discussion and analysis below assumes these rules are agreed and place very few, if any, serious restrictions on the use of these mechanisms. This is unlikely, based on developments thus far, but is simply a working assumption for doing our computations.

For each Annex B (industrialized) country, its emissions outlook under the two scenarios described earlier is compared with its Kyoto target. If the emissions would exceed the target, then the country has a "deficit" in its account and a resulting "demand" for additional credits or allowances through the flexibility mechanisms. If the emissions, on the other hand, would be lower than the target, then the country (Russia, for example) has a "surplus" or "supply" of emission allowances that it could sell to those countries that are in deficit relative to their targets.

Based on the estimates for 2010 shown in Table 1 , it appears that the OECD countries as a whole will have a potential demand for credits or allowances of between 1.7 and 3.0 billion tons of CO_2 equivalent. The low end of this range corresponds to the Pain Threshold Scenario, under which each of these countries takes every reasonable economically and politically feasible measure within its borders first before looking for credits from outside.

The largest part of the OECD demand for credits, about 1.2 of the 1.7 billion tons in the low estimate and about 1.8 of the 3.0 billion tons in the high estimate, is from the U.S. These numbers may even be on the low side, unless trends in the transport sector (like cheap gasoline and proliferating sport utility vehicles) change rather significantly. The biggest issue affecting U.S. emissions in the next 10 years is the restructuring and opening up of electricity markets, which could affect emissions either way.

Against these estimates of potential demand for credits, one must look at the potential surplus or supply of credits from Russia and Eastern Europe. As noted, the supply is measured by the degree to which emissions for these countries may be below the targets set for them in Annex B of the protocol. Because the data for non-OECD countries is of generally poorer quality (or even nonexistent), it is rather difficult to estimate the potential supply of emission credits or allowances. The best estimate (given these limitations) is shown in Table 2 (page 57) to range between about 250 million and slightly less than 1.3 billion tons of CO_2 equivalent.

But the supply estimate of Table

2 only indicates the upper boundary on supply that might in theory be available. However, all indications are that full-scale emissions trading will not occur by 2008-2012 (the first commitment period). The only industrialized country with any significant surplus to sell is Russia, and it has already indicated publicly that it will not engage in emissions trading under Article 17 of the protocol before 2013 at the earliest.

The changes in economic lifestyle required by Kyoto are unprecedented since World War II.

While Russia's political future is hard to predict, several considerations help to explain why Russia will favor joint projects with foreign countries rather than broad-scale emissions trading. Among these are negative experiences with privatization of state-held assets, serious difficulty in organizing its domestic economy, distrust of international markets in general, and caution about venturing too quickly into a market that does not even exist yet.

Developing Countries: No Limits

Developing countries do not participate in trading because they do not have emission limits. And no major developing countries (China, India, Brazil, etc.) will take on voluntary targets at this time because they are not willing to limit their economic growth. For countries in the mid to later stages of rapid industrialization, there is a high correlation between energy consumption (which generally means CO_2 emissions) and GDP. This is somewhat less the case for mature economies like the U.S., although there is still a correlation as long as the manufacturing sector contributes a significant portion of GDP.

Although Kazakhstan and Argentina indicated a willingness at Buenos Aires to consider emissions ceilings, it is not yet clear what these limits might look like. Neither country is likely to agree to limits on emissions that would constrain in any way their economic growth prospects. And even if they did accept targets that allowed them to trade away any surplus, neither could contribute enough to make a significant difference in relation to the huge disparity between the OECD demand for credits and the likely available supply from all sources. The only countries that might make a real difference,. if they were to accept emission limits that allowed them to participate in emissions trading, are China and India. But China's CO_2 emissions alone grew by 21 percent (about 600 million tons) between 1990 and 1995, while India's grew by 25 percent (about 200 million tons). In order to have surplus emissions available to trade internationally, China and India would have to have treaty limits on their emissions even higher than their current rates of growth, which imply a doubling of emissions by 2010. However, the major developing countries have given every indication that they won't consider any limit on their emissions.

In brief, then, the developing countries will not be a source of emissions credits that can be traded with the industrialized nations.

Joint Projects: A Limited Solution

If emissions trading will not be a source of significant credits before 2013, then the only other way the industrialized countries can get credits for protocol compliance is through projects that help other nations limit greenhouse gas emissions. These come in two categories.

Projects in Russia and Eastern Europe fall under Article 6 of the Kyoto Protocol (Joint Implementation or JI). Projects in the developing countries, the Clean Development Mechanism (CDM), are covered by Article 12. However, such joint projects cannot begin to generate enough credits to cover the OECD deficits.

Project-based credit supply is inherently much less than the supply that might be available, theoretically, from emissions trading. Each project must be organized, certified as adding to reductions that would already occur, and meet other criteria still to be defined. This means delays in starting such projects and limited volumes of credits once the projects are implemented.

A realistic project-based credit supply from Russia and Eastern Europe (through JI) is probably only about 100 to at most 300 million tons, or about 10 percent of the demand from the OECD countries. In addition, the maximum likely range for CDM credits from developing countries by 2010 is at most 200-300 million tons. These two ranges can not be added together, because donors will need to choose in some cases between potential projects either in Eastern Europe or in developing countries.

Taking all these considerations into account, the total supply of credit from all three mechanisms is probably about 200-500 million tons at most. Most of

Table 2: Possible Suppliers of Emissions Credits

Country	1990 Actual Emissions	Kyoto Target	High Scenario	Resulting Surplus	Low Scenario	Resulting Surplus
BULGARIA	125.8	115.7	108.1	7.6	87.6	28.1
ROMANIA	246.8	227.0	238.6	-11.6	194.5	32.5
UKRAINE	916.3	916.3	836.8	79.5	609.8	306.5
RUSSIA	3038.4	3038.4	2847.3	191.2	2161.0	877.4
TOTAL (10 Countries)	4552.7	4505.4	4256.9	248.5	3220.5	1284.8

This table projects possible supply available from former communist countries whose projected emissions may be less than their Kyoto targets (in million tons CO_2 equivalent). Under the high scenario (economic recovery) there will be relatively small surpluses of emissions credits for sale. Under the low scenario (economic stagnation), more surplus emission credits are available. Source: Reinstein & Associates International.

the credits would come from projects, either from Joint Implementation or the Clean Development Mechanism. Of the total, emissions trading is expected to contribute very little in this time-frame, since Russia has already indicated it is unlikely to participate until later.

Even this range of credits from JI and CDM is quite significant. It implies perhaps 3,000 to more than 10,000 projects, if the information about average project size is any indication. But when this supply estimate is compared with the demand estimates shown in Table 1, this still leaves the U.S. and other OECD countries far short of their Kyoto targets. If the U.S., for example, were to acquire the entire global supply of credits, this would cover less than half its needs in the best-case scenario and less than 10 percent of its needs in the worst case.

To cover the best-case deficit of the OECD countries (1.7 billion tons) would require at least 20,000 projects and possibly as many as 40,000 projects, based on the experiences of countries to date with the pilot phase of "activities implemented jointly" under the 1992 Climate Change Convention. The higher deficit in the Trend Scenario might require as many as 70,000 projects.

This is far beyond the capability of any foreseeable system to identify, evaluate, certify, fund and monitor. Experts say that even with unlimited budget increases, it would be almost impossible for the U.S. to process more than 300 projects a year, and only about a third of these would probably meet standards and be approved.

The analysis presented here has not addressed the question of costs. Any future international market for emission credits is going to be dominated by the largest buyers (in this case the U.S.) and the largest sellers (most likely Russia, at least in the near term). In such a situation where the demand for credits far exceeds the supply, the sellers of such credits have no incentive to price them cheaply and are likely to price them close to the marginal cost of domestic emissions reductions for the largest buyer of credits. Thus, the cost to the U.S. of achieving the Kyoto target with full use of the flexibility mechanisms is likely to be only slightly discounted below the cost that would be incurred without the mechanisms.

Absence of Balance

One of the problems emerging from the Kyoto results is an apparent lack of balance in the relative commitments of different countries or groups of countries. In trade negotiations there has always been a requirement that the concessions on tariff reductions or other commitments of one country more or less balance those of other countries. This balance has been essential in getting agreement for ratification or approval of the final package.

Such concerns for balance appear not to have influenced decisions on the Kyoto targets. The U.S. target implies a reduction in emissions of between 30 and 40 percent relative to where current trends would take emissions by 2010. In contrast, the EU target is only about 15 percent below the level where its current trends are leading. The lower EU trend is due not to actions taken in Europe to limit greenhouse gas emissions but almost entirely to economic restructuring following German reunification and to liberalization of British electricity and coal markets.

The U.S. approach seems based on an almost religious faith in environmentalism.

There is an obvious concern on the part of some industries that the large difference between the U.S. and EU commitments in Kyoto may lead to major distortions and adverse impacts on trade and competitiveness. This concern is further heightened by the total lack of any commitments in the Kyoto Protocol by the developing countries regarding their future energy consumption and emission levels.

The Triumph of Ideology

The conclusions regarding the feasibility of the Kyoto targets raise serious questions about the way in which the U.S. approached the Kyoto negotiations. In the past, the U.S. always knew more or less what it could do, and what it could live with, from a technical, economic and political point of view. This has certainly been the case in every major trade negotiation, but also characterized the U.S. position in negotiating the 1987 Montreal Protocol on ozone-depleting substances — with subsequent major amendments in London (1990) and Copenhagen (1992) — which has been frequently cited as one of the most successful international environmental treaties.

But this pragmatic approach was basically abandoned in negotiating the Kyoto Protocol. Analysis was done, to be sure, but it was largely to support preselected positions that were based more on ideology than on a solid understanding of what could actually be achieved in greenhouse gas emission reductions. Some negotiators were surprised, even shocked, when the U.S. departed from its traditional approach and, under specific guidance announced publicly by Vice President Al Gore in Kyoto, agreed to targets that appeared to be beyond any reasonable assessment of feasibility.

The basic problem with the approach the U.S. has taken on climate change is that it depends on a relatively near-term fundamental change in people's thinking and behavior in both the U.S. and developing countries. It implies a leap of faith, as in the fantasy-movie "Field of Dreams," in which the hero insisted: "If you build it, they will come" (i.e., the new technologies, changes in consumer behavior, selfless attitudes on the part of major developing countries, will all somehow materialize). Without such fundamental changes, the Kyoto targets can not be met.

But in fact, there are no guarantees that any of these changes will materialize, and numerous reasons to believe they will not materialize in the required time-frame. After all, 2010 is almost tomorrow in terms of the required turnover of major capital stock (such as power plants, steel mills and urban transport systems).

Environmentalism as Religion

There are a number of parallels between the environmental ideology of the 1990s as found in Western Europe (and parts of the current U.S. administration) and past religious ideologies. Those who question the basic approach of this ideology and try to argue on the basis of facts and numbers are accused of "old thinking." A great deal of the new approach depends on fundamental beliefs and a degree of faith that certain things will happen by a certain time. This is the essence of the "technology forcing" approach to environmental goals — i.e., forcing new technology to come into being by fiat.

The more recent swing from pragmatism to ideology exemplified by the Kyoto Protocol has fundamental implications for America's economic well-being, domestic politics and relations with other countries, as well as the longer-term process of international cooperation across a very broad range of issues. There are big dangers in following this approach.

For example, a wrong-headed approach to climate change and other issues, rather than stimulating the desired technological advances, may hinder them by draining away too many resources for short-term, narrowly focused results like the Kyoto targets. Once industry and others have been forced to make major capital investments in converting to the best available current technologies in order to meet near-term targets, they will resist replacing these investments in a few years with new superior technologies — the economic cost of premature retirement of the relatively recent investments will simply be too high. This in turn sends a negative signal back to the research side in terms of the market potential for the new technology.

And if the targets are simply beyond what is feasible, as my analysis suggests, then international progress toward a more realistic approach is delayed while countries ponder how to achieve such targets, or how to explain their inability to move forward with the ratification process. There are already signs that a number of countries will hold back from ratifying at least until they see the U.S. ratify. And the U.S. Senate has already expressed grave reservations about ratification.

Discrediting the Process

With each passing year, countries will be one year closer to the beginning of the first commitment period in 2008, and emissions will have continued to rise in most countries in line with the Trend Scenario. As the impossibility of many countries' achieving the targets becomes more evident, there is also likely to be some finger-pointing in an effort to blame the embarrassing result on someone. None of this can be considered beneficial for the global environment.

Moreover, there is a real risk that the international process by which the targets were negotiated may become discredited. If the public believes these and other international efforts tend to produce unrealistic and unbalanced results, it may turn its attention away from such efforts and withdraw its support. An unworkable international regime casts doubt on other similar agreements.

Such a result would clearly be contrary to longer-term U.S. interests, not only in the environmental field but also in trade, security and many other areas. But hopefully the Kyoto Protocol is an anomaly and not really an indication of the general direction of U.S. foreign policy. Rather, one hopes the U.S. will return in the near future to its traditional approach of negotiating what is achievable and deliverable, not only in environmental negotiations but across the broader spectrum of international cooperation. This has long been one of the real strengths of U.S. foreign policy, and it is an approach that most of the rest of the world expects and needs from the United States. ■

LIFE AFTER THE FOREIGN SERVICE?

For a future issue, the *Journal* would like to hear from former Foreign Service employees about your new lives. What was the transition like? How have you incorporated knowledge acquired in the Foreign Service into your current professional life? (*That includes people now contracting for their former agencies, or working in their previous fields in new capacities.*) What about finances? Public service and volunteer activity? Leisure pursuits?

We'd like to hear both from those who
retired after a lengthy career
and those who departed relatively early.

If you have an article you would like to write, are willing to tell your story to the *Journal*, or have other suggestions, please contact the *Journal*'s editor, Bob Guldin, by mail, e-mail (guldin@afsa.org) or fax (202) 338-8244.

THE KYOTO PROTOCOL AND ENERGY-INTENSIVE INDUSTRIES

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This paper briefly examines the situation of energy-intensive industries as they may be affected by the Kyoto Protocol, which would require stringent reductions in the use of fossil fuels by those industrialized countries that may ratify and implement it. These industries are especially important to the economy and would probably be disproportionately and adversely affected by the Protocol.

Greenhouse Gas Emission Limits Under the Kyoto Protocol

On December 11, 1997, more than 160 countries adopted the text of the Kyoto Protocol to the UN Framework Convention on Climate Change (FCCC). The purpose of the Protocol is to limit human emissions of greenhouse gases (GHGs) in order to try to diminish possible human influence on the global climate system. Scientific computer models suggest that without any actions to limit emissions of these gases, there may be serious and possibly irreversible changes in the climate system over the long term (50 to 100 years).

The Protocol was opened for signature at UN Headquarters in New York on 16 March 1998 and many countries have since signed the Protocol, indicating their political commitment to seek ratification in accordance with their national constitutions and laws. The Protocol will enter into force following ratification by at least 55 countries accounting for at least 55% of 1990 industrialized-country carbon dioxide (CO_2) emissions.

The Kyoto Protocol would require each industrialized country that ratifies it to limit its emissions of six GHGs during the period from 2008 to 2012 to the levels set forth in Annex B to the Protocol. The overall objective is a reduction for these countries as a whole of at least 5% below the level of emissions in 1990. Developing countries, however, would have no obligations under the Protocol to limit their emissions.

Individual country targets in Annex B range from an 8% reduction for EU countries and most other European countries to a return to 1990 levels for Russia and Ukraine and increases of up to 10% above 1990 levels for three countries (Norway, Australia and Iceland), because of special national circumstances in these countries. The US target is a 7% reduction from 1990 levels, while Japan and Canada each pledged to a 6% reduction.

The targets cover six human-related greenhouse gases: CO_2 (from all sources), methane (CH_4), nitrous oxide (N_2O), hydrofluorocarbons (HFCs), perfluorocarbons (PFCs) and sulfur hexafluoride (SF_6). For the last three gases, which account for a very small proportion of total emissions, countries may choose either 1990 or 1995 as the base year for purposes of reduction commitments.

In addition, potential flexibility in meeting national targets is provided in the Protocol through three mechanisms that would allow transfers or crediting of emissions reductions achieved in other countries, as follows:

- Article 6 allows Annex B Parties to share emissions credits resulting from joint implementation (JI) of projects that result in net reductions of GHG emissions.
- Article 12 establishes a Clean Development Mechanism (CDM) under which funding of approved projects in non-Annex B (developing) country Parties is to promote sustainable development and also generate emissions credits for donors.
- Article 17 allows for the possibility of transfer of credits or allowances through international emissions trading.

However, the rules, guidelines, modalities, verification procedures and other aspects of these mechanisms are still to be agreed by countries.

The Kyoto Protocol Would Place Severe Limits on Energy Use

The most important greenhouse gas in terms of human emissions is CO_2, accounting for over 80% of total emissions of all six Kyoto Protocol gases by industrialized countries. About 97% of CO_2 emissions result from the combustion of fossil fuels (coal, oil and natural gas). These fuels, in turn, account for about 85% of total energy use. Thus, any targets for limiting GHG emissions will have a significant impact on energy use.

The Kyoto targets in particular would impose very severe limits on energy use. Most countries' emissions are projected to rise significantly by 2010. US emissions, for example, have been projected to increase by 30% or more over 1990 levels by 2010 if they continue to follow the pattern of recent years, which has already included improvements in energy efficiency. The US Kyoto target of a 7% cut from 1990 levels would thus require an overall reduction of nearly 40% from where emissions are likely to be in a little over 10 years.

Who are the Energy-Intensive Industries?

The energy-intensive industries are basic manufacturing industries that transform raw materials and semi-finished goods into finished goods that are used throughout modern societies. Any process that involves the physical and/or chemical transformation of material requires significant energy inputs. If you make things, you have to use energy. Examples of energy-intensive industries include:

- Chemicals: This sector includes petrochemicals, basic inorganic chemicals, plastics, synthetic fibers, rubber, fertilizers and a broad range of other products that are used either directly as consumer products or indirectly as inputs to further manufacturing processes. Chemical industry products vary in their energy intensity but all use substantial amounts of energy, usually in the form of heat, in order to bring about chemical transformation of the inputs. Some chemical industry subsectors, such as plastics and rubber, also require energy for physical transformations to shape the final product.

- Petroleum refining: This sector transforms crude oil input into a broad range of fuels (such as gasoline, diesel fuel, LPGs, kerosene, home heating oil, jet fuel and heavy industrial fuel oil) and other non-fuel products (such as lubricating oils and greases, waxes and asphalt). The basic process begins with boiling the input crude oil and separating it into components through fractional distillation. Further transformation of the intermediate streams into finished products also requires substantial amounts of heat for chemical transformation.

- Primary metals: This sector includes a number of subsectors such as iron and steel, aluminum, copper, lead, zinc, and magnesium. Large amounts of energy as heat and other inputs are required for the physical and chemical transformation of metal ores into basic metal products and for the further physical transformation of these products into finished products.

- Construction materials: This sector includes cement, brick, lime, glass and other materials used in construction of buildings, roads and other aspects of the physical infrastructure of the economy. The production of these products from mineral ores and other raw material inputs is extremely energy intensive and may account for up to half of the cost of production of some products.

- Pulp and paper: This sector includes not only the many types of paper but also cardboard and other paper-based packaging materials. The conversion of cellulosic raw material from trees and other plants is very energy intensive, and the industry has made major efforts to use various byproducts of the conversion process as a source of energy.

Why Are These Industries Important to National Economies?

Large sectors of the downstream economy (other industries and consumers) are dependent on the output of these basic energy-intensive industries. To illustrate how widespread this dependency is:

- The transport sector would come to a complete halt without the gasoline, diesel fuel and jet fuel produced by refineries.

- Without steel, aluminum, plastics and rubber, there would be no automobiles, trucks or airplanes in the first place.

- There would be no building construction without cement, bricks and glass, and without the insulation that also is produced by energy-intensive industries.
- Almost all furniture and appliances would disappear without the plastics, wood composites, metals, synthetic fibers, foam insulation and other material that account for most of their production.
- Medicines that are derived from organic chemicals would not be available.
- Many foods would not be available because of the lack of packaging and insulating materials produced by the chemical and pulp and paper industries, and the lack of refrigeration that also depends on the output of the energy-intensive industries.
- Even many of the clothes we wear depend on the output of these sectors.

Adverse impacts on the energy-intensive industries would affect other sectors as well. Some requirements could be met by imports, but there could also be some supply interruptions. Although the energy-intensive industries employ many people, they are not especially labor-intensive. However, employment by the downstream industries that depend on the output of energy-intensive industries numbers in the millions, and could be adversely affected by any impacts on energy-intensive industries. And those jobs that are provided by the energy-intensive industries are relatively high-paying "white-collar" and "blue-collar" jobs, so that any job losses that might occur would have proportionately greater impacts on a per-capita basis.

For a number of countries there is also a national security aspect to the energy-intensive industries. Many of these sectors would be critical to meeting national security objectives in the event of a threat to the country that required a reallocation of raw materials and basic industrial output.

An effective response to climate change through improvement of energy efficiency throughout the economy could also be adversely affected by measures that hurt the ability of these industries to develop new technologies and products by significantly reducing capital available for research and development. Although these industries consume significant amounts of energy, they also contribute to saving significant amounts of energy through the products they produce, for example, foam insulation, light-weight aluminum products, plastic car bumpers and other parts that improve vehicle fuel efficiency by reducing vehicle weight, and so forth.

How Are Energy-Intensive Industries Affected by Changes in Energy Prices?

Energy-intensive industries are significantly affected by anything that changes the cost of energy. In terms of how energy costs affect the overall cost of production for these industries, for example,

- The cost of crude oil is about 85% of total cost of materials for petroleum refining, and represents about three-fourths of the value of shipments by this sector. Nearly 10% of the crude oil input to refineries is consumed as refinery fuel.
- About 70% of the cost of producing plastics and resins, and over half the cost of production of synthetic fibers, is for purchase of oil and gas for fuel and feedstock. For other organic chemicals the cost is almost as high.
- About two-thirds of the cost of ammonia and other nitrogen fertilizer production is for fuel and feedstock.
- Over half of the cost of hydraulic cement production is due to energy costs.
- For primary aluminum, energy in the form of electricity represents about half the cost of production.

In the context of the larger economic situation of these industries, including not only production costs but other factors as well:

- Because the output of most energy-intensive industries is a commodity product, it must compete on world markets on the basis of price.
- Even small changes in energy costs can seriously affect the competitiveness of these products.
- For this reason, many of the manufacturing facilities of the energy-intensive industries were either substantially improved in energy efficiency or else shut down in response to the rapidly increasing energy prices of the 1970s and early 1980s.
- As a result of this earlier intense focus on reducing energy consumption, they do not have many "low cost" reduction alternatives available today.
- As a group, they have already (for the most part) switched to natural gas, they are the largest owners of natural gas-fired cogeneration, and they have installed relatively energy-efficient equipment.
- These industries are very capital-intensive. Their plants last from 20 to 50 years and capital stock turnover is slow and expensive.
- Break-through technology that provides "significant" energy efficiency improvement is being sought because it is the key to improvement in competitiveness; however, it takes a significant amount of time and investment to create such technology, and even longer to eventually incorporate it into the capital stock.

In these respects, energy-intensive industries differ in some important ways from the other sectors that are the principal sources of GHG emissions (electric utilities, transportation, and residential and other buildings). Among the other differences:

- Because they have few options for switching to alternative energy sources or technologies, an absolute limit on their emissions as part of an overall national emissions target is inconsistent with the ability of these industries to grow and provide the products that society demands.

- The cost of measures to limit GHG emissions, such as energy taxes and/or carbon permits, would detract from the desired behavior of these industries of investing in new technology development and new less carbon intensive capital equipment.

- Between 1980 and 1994, overall energy use by all US industries fell by 21% and that of key energy-intensive industries by 24%, while total US energy use increased by 13%.

- This compares rather dramatically with the increases in energy use by other US sectors over the same period, for example by electric utilities (31%), by transportation (22%) or by other sectors, including residential and other buildings (8%).

- For all G-7 major industrialized countries combined (Canada, France, Germany, Italy, Japan, UK and US), the changes over this same period were a 12% reduction for all industries and a 9% reduction by key energy-intensive industries, as contrasted with an increase in total energy use of 14%; utilities increased by 44%, transportation by 27% and other sectors by 12%.

- Of great concern to energy-intensive industries is the potential of an industry-wide or company limit on emissions that would penalize them by having to pay twice: once for historical energy efficiency investments and secondly for purchase of carbon permits or other flexibility necessary to allow them to meet basic economic needs.

How Are These Industries Potentially Affected by the Kyoto Protocol?

The sensitivity of the international competitiveness of energy-intensive industries to any major change in energy prices raises a number of concerns regarding the stringent targets contained in the Kyoto Protocol. Because the Protocol would require reductions in fossil fuel use ranging from at least 10% below projected levels to possibly 40% or more, it is inevitable that there would be a very significant impact on energy prices.

Most of these industries have few options for the introduction of fundamentally new technologies that can result in dramatic improvements in energy efficiency. As noted, many already made investments in the past in order to improve efficiency for economic reasons. Because these industries compete in global markets where developing country producers would not face similar emission targets, most would simply have to absorb price increases for fuels and raw materials.

Even among industrialized countries, there are significant differences in the way in which each country must limit its emissions.

- The targets vary from one country to another, ranging from 8% below 1990 levels to 10% above 1990 levels.
- Countries differ significantly in their available energy mix, with some having plentiful domestic resources and other having few or none, some having plentiful hydro power or other emission-free sources and other having none, and so forth.
- Countries differ in how their emissions are divided among individual sectors, with some having a high percentage from the electric utility sector and others a low percentage (related to the available energy mix), some a high percentage from heating and cooling of buildings and others a low percentage (because of differences in climate), and so forth.

All these differences translate into significant differences in the way in which energy-intensive industries in each country will be affected by that country's implementation of the emission limits under the Kyoto Protocol. And this in turn means shifts and distortions in international markets for the products made by these industries.

These distortions may be further influenced by the particular measures a country adopts to meet its Kyoto target. For example, some countries may use taxes to reduce demand for energy, while others may use other forms of regulation. Taxes may be applied uniformly among all energy users or may favor some forms of energy over others and some users over others. Some governments may exempt their energy-intensive industries from taxation while others may not.

The use of emission trading schemes to create flexibility in the achievement of emission limits would also raise energy prices because users of fossil fuels would have to bid for emission allowances under such an approach in order to meet their energy use requirements. Since the supply of such allowances (as determined by each country's Kyoto target) would be significantly below the potential demand, the price of the allowances would be very high, and would grow higher over time. The cost to industry of acquiring the necessary allowances would be added onto the basic price of energy. Other energy users might have more flexibility and be in a better position to offer higher prices for the allowances than many energy-intensive industries could afford to pay in a competitive global market for their output.

Moreover, a majority of countries (the developing countries) do not have any emissions targets at all. Thus there is the potential that energy-intensive industries may feel pressured or forced to move their production facilities to these countries in order to maintain their competitiveness in world markets. In such a situation, there would be no overall benefit to the global environment but simply a shift of economic activity (including jobs) from one location to another.

Investment in individual projects to reduce energy use (and emissions) in other countries in order to gain emission-reduction "credits" through the project-based flexibility mechanisms in the Kyoto Protocol (CDM and JI) may offer only limited opportunities to energy-intensive industries. Because of the intense global competitiveness, such companies investing in the CDM projects that may directly or indirectly support their competitors (in the developing country) is not likely. Such companies would only consider investing in their "own" plants in developing countries.

All of these considerations serve to highlight the dilemma of the energy-intensive industries in relation to the Kyoto Protocol. These industries, like all businesses, seek to grow and share in the overall growth of the global economy. As the world's economy grows and more countries become developed, the demand for the contributions of these industries to society grows even faster. But in order to grow and meet these societal requirements, these industries must consume energy, and that means they must increase their emissions.

Yet the Kyoto Protocol would set limits on their emissions in most countries that are far below the levels that would occur under the most optimistic assumptions. Even with the most modest growth assumptions and with all reasonable improvements made in their energy efficiency, these industries simply can not reach the Kyoto targets. In this situation, how are they to meet the growing needs of more and more of the world's people? The special situation of the energy-intensive industries will need to be addressed by governments in a manner somewhat different from that for other sectors.

UNITED STATES: CHANGES IN ENERGY USE BY SECTOR, 1980-1994

	1980	1985	1990	1994
Total (thousand TOE)				
Industry	445,557	389,232	382,258	352,507
Iron & steel	42,139	27,615	26,118	16,076
Chemicals	65,955	57,276	76,503	79,924
Nonferrous metals	12,085	8,395	7,222	7,823
Non-metallic minerals	10,500	11,326	10,587	10,229
Paper, pulp & print	42,836	44,998	21,356	17,325
Heavy industries	173,516	149,610	141,786	131,376
Total energy supply	1,800,962	1,771,233	1,913,590	2,037,976
Electric utilities	327,515	363,735	415,983	429,259
Industry	445,557	389,232	382,258	352,507
Transportation	432,932	449,899	502,013	530,118
Other	398,175	398,775	403,359	429,363
Change vs. 1980				
Industry	1.000	0.874	0.858	0.791
Iron & steel	1.000	0.655	0.620	0.382
Chemicals	1.000	0.868	1.160	1.212
Nonferrous metals	1.000	0.695	0.598	0.647
Non-metallic minerals	1.000	1.079	1.008	0.974
Paper, pulp & print	1.000	1.050	0.499	0.404
Heavy industries	1.000	0.862	0.817	0.757
Total energy supply	1.000	0.983	1.063	1.132
Electric utilities	1.000	1.111	1.270	1.311
Industry	1.000	0.874	0.858	0.791
Transportation	1.000	1.039	1.160	1.224
Other	1.000	1.002	1.013	1.078

Source: International Energy Agency, *Energy Balances of OECD Countries*

G-7 MAJOR INDUSTRIALIZED COUNTRIES: CHANGES IN ENERGY USE BY SECTOR, 1980-1994

	1980	1985	1990	1994
Total (thousand TOE)				
Industry	873,598	793,801	802,607	765,291
Iron & steel	141,365	116,101	111,797	97,336
Chemicals	182,515	174,146	200,470	209,775
Nonferrous metals	27,585	22,126	21,316	23,135
Non-metallic minerals	47,307	44,389	44,674	43,726
Paper, pulp & print	70,782	73,126	52,784	54,159
Heavy industries	469,555	429,887	431,042	428,131
Total energy supply	3,231,433	3,226,686	3,499,234	3,695,089
Electric utilities	533,490	615,453	713,119	769,402
Industry	873,598	793,801	802,607	765,291
Transportation	673,304	696,226	804,120	856,728
Other	750,542	767,334	780,210	840,632
Change vs. 1980				
Industry	1.000	0.909	0.919	0.876
Iron & steel	1.000	0.821	0.791	0.689
Chemicals	1.000	0.954	1.098	1.149
Nonferrous metals	1.000	0.802	0.773	0.839
Non-metallic minerals	1.000	0.938	0.944	0.924
Paper, pulp & print	1.000	1.033	0.746	0.765
Heavy industries	1.000	0.916	0.918	0.912
Total energy supply	1.000	0.999	1.083	1.143
Electric utilities	1.000	1.154	1.337	1.442
Industry	1.000	0.909	0.919	0.876
Transportation	1.000	1.034	1.194	1.272
Other	1.000	1.022	1.040	1.120

Source: International Energy Agency, *Energy Balances of OECD Countries*

KYOTO PROTOCOL: EMISSIONS OUTLOOK & FLEXIBILITY MECHANISMS

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Abstract

The following paper[2] examines the outlook for greenhouse gas (GHG) emissions of industrialized countries in the year 2010 in relation to the emission limitation and reduction targets agreed to in the Kyoto Protocol adopted by most countries of the world in December 1997. It further examines whether certain flexibility mechanisms included in the Protocol would enable countries unable to reach their targets by domestic measures alone to offset any shortfall by "credits" obtained through these mechanisms. Finally, the paper discusses the implications of these results for the eventual ratification of the Protocol by a sufficient number of countries to trigger its entry into force.

Major Conclusions

The major conclusions of the paper are the following:

- Relatively few countries are on an emissions path, even under the most optimistic scenario, that would enable them to meet the Kyoto targets.

- Rules, guidelines, modalities, procedures and so forth governing the flexibility mechanisms, including for monitoring and verification of results, are unlikely to be agreed in any great detail for a few years.

- Even if these rules are agreed and place almost no restrictions on the use of credits from the flexibility mechanisms, the range of demand for such credits exceeds the likely supply of credits by a factor of at least 2 and possibly more than 10.

- Given this outlook, the United States (the world's largest GHG emitter) is unlikely to be able to obtain the necessary agreement to ratification from the US Congress, and enough other countries will probably withhold ratification as well, so that the conditions for entry into force specified in the Protocol will not be met.

- A new separate legal instrument (treaty) is probably necessary to modify certain provisions of the Protocol in order to allow key countries to ratify; this new instrument would be negotiated sometime between 2003 and 2006

Overview of the Kyoto Protocol

On December 11, 1997, more than 160 countries adopted the text of the Kyoto Protocol[3] to the UN Framework Convention on Climate Change (FCCC)[4]. The Protocol was opened for signature at UN Headquarters in New York on 16 March 1998 and many countries have since signed the Protocol, indicating their political commitment to seek ratification in accordance with their national constitutions and laws. The Protocol will enter into force following ratification by at least 55 countries accounting for at least 55% of 1990 industrialized-country CO_2 emissions.

The Kyoto Protocol would require each industrialized country that ratifies it to limit its emissions of six greenhouse gases during the period from 2008 to 2012 to the levels set forth in Annex B to the Protocol. The overall objective is a reduction for these countries as a whole of at least 5% below the level of emissions in 1990. Individual country targets in Annex B range from an 8% reduction for EU countries and most other European countries to a return to 1990 levels for Russia and Ukraine and increases of up to 10% above 1990 levels for three countries (Norway, Australia and Iceland), because of special national circumstances in these countries. The US target is a 7% reduction from 1990 levels, while Japan and Canada each pledged to a 6% reduction.[5]

The targets cover six human-related greenhouse gases: carbon dioxide (CO_2), methane (CH_4), nitrous oxide (N_2O), hydrofluorocarbons (HFCs), perfluorocarbons (PFCs) and sulfur hexafluoride (SF_6). Emissions are to be counted for all sources of these gases, but the methodology for counting uptake of these gases by sinks, while agreed in principle, has yet to be determined. For the last three gases, which account for a very small proportion of total emissions, countries may choose either 1990 or 1995 as the base year for purposes of reduction commitments.

The Member States of the European Union will achieve their common target of an 8% reduction (92% of 1990 levels) jointly rather than individually, in accordance with Article 4 of the Protocol. This requires these countries to agree among themselves on how each individual country will contribute to the achievement of their common target. The burden-sharing among EU Member States should also take into account differences in national circumstances among the Member States as specified by the Council Conclusions adopted by EU environment ministers in March 1997.

In addition, potential flexibility in meeting national targets is provided in the Protocol through three mechanisms that would allow transfers or crediting of emissions reductions achieved in other countries, as follows:

- Article 6 allows Annex B Parties to share emissions credits resulting from joint implementation (JI) of projects that result in net reductions of GHG emissions.
- Article 12 establishes a Clean Development Mechanism (CDM) under which funding of approved projects in non-Annex B (developing) country Parties is to promote sustainable development and also generate emissions credits for donors.

- Article 17 allows for the possibility of transfer of credits or allowances through international emissions trading.

However, the rules, guidelines, modalities, verification procedures and other aspects of these mechanisms are still to be agreed by countries.

National Circumstances and the Approach to Estimating Emissions

There are many significant differences in national circumstances that directly and indirectly affect a country's emissions pattern, and its ability to meet a particular target for future emissions levels. This was recognized already in the original Framework Convention in 1992, which states that efforts to limit emissions will take into account "the differences in these Parties' starting points and approaches, economic structures and resource bases, the need to maintain strong and sustainable economic growth, available technologies and other individual circumstances, as well as the need for equitable and appropriate contributions by each of these Parties."

Differences in starting points and approaches can include such differences as, for example, differences in climate, geography, location, levels of energy efficiency already achieved before 1990 and other factors that clearly affect energy use and the potential to reduce further emissions of CO_2 and other greenhouse gases. Included in economic structure and resource bases would be not only the energy resources and available fuel mix but also factors like energy-intensive manufacturing industries based on non-energy resources such as forests.

Any assessment of the emissions outlook of each country must also take into account specific measures that may be available to that country, including the technical, economic and political/market feasibility of various measures, as well as unique social and cultural conditions.

Taking all such factors into account, as well as various political considerations unique to each countries, an in-depth analysis of historical emissions patterns and the emissions outlook has been developed for each Annex B country for the period 2008-2012, assuming the year 2010 as representative of the period (as discussed below).

Sources of emissions have been examined by sector for each of the three principal anthropogenic GHGs: CO_2, CH_4 and N_2O. In addition, CO_2 emissions from fuel combustion were also analyzed by fuel source (coal, oil and natural gas). Emissions were examined only in the aggregate for the three additional categories of GHGs covered by the Kyoto Protocol: HFCs, PFCs and SF_6. For several countries there was no information on these gases, but since the effect of these gases is quite small, they were simply not included in the estimates for these countries.

2010 Target vs. 2008-2012 Multi-Year Target

A few relatively simple calculations reveal the differences between the Protocol five-year commitment period and the alternative of a single-year target for the year 2010. In principle the multi-year approach gives added flexibility. But it can also make the target more difficult, depending on national circumstances and the specific measures implemented in order to reach the target.

The main reason for this is that most measures planned by countries to limit their emissions are one-time measures, such as switching from coal to natural gas, that will not be repeated in later years. One time reductions have quite a different effect from basic structural changes that result in a steady downward trend in all future years. All changes in fuel mix to lower-carbon or carbon-free energy sources result in one-time reductions. Increased building efficiency through greater insulation, more efficient windows and doors or more efficient lighting is also a one-time change. All of these measures lower the base line of emissions when initially implemented and also lower the rate at which emissions might otherwise increase in the future.

However, if the switch is to a lower-carbon fuel, then future increases in energy demand, associated for example with economic and population growth, will mean increases in emissions, although at a lower rate than would occur with a more carbon-intensive fuel. Buildings and automobiles may be more efficient, but increased population will mean more buildings and more cars, and thus more emissions.

What this means is that countries already need to make one-time reductions by 2008. The longer they delay after that, the more difficult it will be to meet their target. And even if they meet the target in 2008, they will need to find additional measures to compensate for emissions growth that might otherwise occur after that. If the total effect on emissions of economic and population growth between 2008 and 2012 is, for example, 2% annually, then additional measures will be required to offset more than 8% increased emissions even after reaching the target in 2008.

The only way to avoid this constant pressure to find new measures every year to offset growth that would otherwise occur is to make fundamental changes in technology and investment that result in decreased emissions in every year as the new technologies are introduced through the turnover in capital stock. However, the timeframe 2008-2012 is much too early to realistically expect that kind of structural change on a scale that would permit the achievement of the Kyoto targets.

One may draw two general conclusions from these considerations of the multi-year target included in the Kyoto Protocol:

- If a country can't reach its Kyoto target by 2008, it will have problems reaching it over the following four years.
- If a country has not reached the target by 2010, it probably can't reach it at all.

Scenarios for 2010

In order to provide a broader perspective on the outlook for industrialized-country GHG emissions, two different scenarios for 2010 are examined for OECD countries:

- Trend Scenario: current trends continue, including additional reasonable measures that can be justified as well for other reasons, according to national political factors (continued good efforts)
- Pain Threshold Scenario: all reasonable economically and politically feasible measures are taken to limit emissions (true best efforts)

As with any scenarios for possible future conditions, these scenarios are not predictions but rather are projections of what might occur given certain policy approaches by different countries. They frame what are considered to be the likely range of results for each country.

The Trend Scenario is similar to what is often referred to as "Business As Usual" (BAU) in many studies. However, it includes the likely effects of a few more additional measures than many BAU scenarios might, since the trend is for governments to seek to identify and implement whatever reasonable measures they can that might limit GHG emissions while providing other benefits as well.

The actual emissions would be lower than the Trend Scenario projections if the Kyoto Protocol were to enter into force. But there is a basic limit on what each country can do to limit its emissions through domestic measures. The Pain Threshold Scenario assumes a country does all that it reasonably can to limit emissions, up to the point where further actions would have unacceptable economic and social consequences (job losses, disproportional regional impacts, individual hardship, etc.). It is assumed that this threshold depends in part on the current state of understanding of the science of climate change, or at least on public perceptions regarding the risks of climate change and related impacts.

This point will necessarily differ from country to country. For example, for some countries a very high value is placed on environmental goals and people are willing to make some sacrifices to achieve these goals, while in other countries this may be less the case. Regional differences in economic activity, which may constrain a country more than national average conditions might suggest, are also different from one country to another. Lifestyles and expectations regarding the levels of certain conveniences and services differ as well. Finally, certain industrial activities that are related to military and security concerns are more important to some countries than to others.

It is most unlikely that countries would go beyond this threshold on the basis of computer model projections, coupled with allegations by politicians (but not supported by most scientists) that recent weather events are due to human GHG emissions. Most people were unwilling to make the kind of sacrifices that would be beyond the Pain Threshold even in the 1970s when there were actual local shortages of energy and a doubling of oil prices.

It is worth noting that both the Trend outlook and the Pain Threshold outlook will change over time. New technologies will emerge and evolve. These will affect the potential to limit emissions in the future, but can not be anticipated with much certainty today. Social and political attitudes will change with time, and may go in either direction. And further developments in the scientific understanding of possible human-induced climate change will certainly affect the outlook, especially the Pain Threshold outlook, but again these can not be anticipated with much certainty today.

The scenarios used for the non-OECD Annex B countries (formerly centrally planned economies) are somewhat different from the two scenarios described above for OECD countries. The lower number corresponds to a scenario where hardly any improvement is made in these countries' economic situation by 2010, while the high estimate assumes most of these countries have progressed reasonably well along the transition path from centrally planned to market economies by 2010:

> (1) Higher economic growth scenario: good progress is made on the transition of the economy from centrally planned to market-based, including investments to improve energy efficiency as electricity production and industrial output increase
>
> (2) Lower economic growth scenario: progress on the transition of the economy from centrally planned to market-based is slow, with fewer investments to improve energy efficiency but much smaller increases in electricity production and industrial output

Summary of Emissions Outlook

The emissions outlook for OECD countries, based on preliminary estimates for each country, is shown in Tables 1 and 2 in terms of CO_2 and in Tables 1A and 2A in terms of carbon equivalent. Table 1 gives the projections for CO_2 emissions from fuel combustion, and Table 2 for all six gases covered by the Protocol. As can be seen from a comparison of the two tables, energy-related CO_2 emissions are the largest part of human emissions of greenhouse gases.

When the emission outlooks in Table 2 are compared with the targets set out in Annex B of the Kyoto Protocol, it is apparent that relatively few countries are on an emissions path, even under the Pain Threshold Scenario, that would enable them to meet the Kyoto targets. The question then arises: Can these countries find a way to meet their commitments either by implementing the commitments jointly under Article 4 of the Protocol or by obtaining various emissions credits from other countries through the flexibility mechanisms of Articles 6, 12 and 17 of the Protocol?

Table 2 shows that the European Union is unlikely to meet its joint target of an 8% reduction from 1990 levels, regardless of how this commitment is divided up through the EU burden sharing. The specific details of the burden-sharing have been discussed elsewhere and will not be addressed here. However, it is apparent from a review of the individual burden-sharing targets in relation to the projections in Table 2 that the impacts of the burden-sharing on individual EU Member States vary

The utility sector accounts for about 40% of total US CO_2 emissions from fuel consumption. Fossil fuels are the source of nearly 70% of net electricity generation, and coal accounts for the largest part of this, although natural gas use is increasing significantly in recent years. Nuclear contributes about 20% of US electricity and hydro somewhat less than 10%, with other sources (geothermal, solar, wind, biomass and combustible waste) accounting for more than 6%.

The abundance of economic and secure coal supply has been the main reason for the dominance of coal in electricity generation over the years. Requirements to reduce emissions of sulfur dioxide (SO_2) and other pollutants from 1990 were anticipated to cause a major decline in coal use, but the reform of rail transportation rates enabled many utilities to obtain low-sulfur coal from Wyoming and other western sources at economic costs and still meet their emission reduction targets. This has kept utility CO_2 emissions high even while their other emissions were declining significantly.

In the transport sector, the second largest source of US emissions, low population density in many areas limits public transport options which might reduce emissions. Even in more densely populated areas the suitability of mass transport is adversely affected by decades of poor land-use planning. The gradual disappearance of old rights-of-way contributes as well to lack of rail options for mass transport.

But beyond these factors there is the lifestyle issue. The US consumer continues to demand fairly large, powerful automobiles that will require increased amounts of oil in coming years. While pressure in a few urban areas may push some drivers away from the traditional auto preferences, in most of the rest of the country these will continue to be the rule.

The outlook for the US depends on a number of trends. As noted, the largest source of US emissions is the utility sector, and several factors contribute to a likely increase in emissions by 2010. For example, competition in the electricity sector and increasingly open access to transmission lines is forcing utilities to lower their costs by maximizing the use of generation capacity with the cheapest marginal cost. For most utilities this means older coal-fired plants that are fully amortized. Coal today accounts for nearly 60% of US electricity generation.

In addition, over the next two decades more than half of the operating licenses for the nearly 110 US nuclear units will expire and management will face difficult choices about how to replace this capacity. Of these, 11 licenses expire by 2010, 34 expire between 2011 and 2015 and 15 expire between 2016 and 2020. Public attitudes in the US are not favorable toward continued or increased nuclear use, and the replacement capacity for any units decommissioned will likely be based on natural gas and coal.

Population growth is another factor contributing to the projected growth in US emissions. Between 1990 and 2010 the US population is expected to grow by nearly 20%, mostly because of immigration. This means the new US residents will begin consuming energy, and emitting CO_2, almost as soon as they arrive in the US.

considerably in regard to relative difficulty in meeting these targets.

The likely failure of most OECD countries to be able to meet the Kyoto targets through domestic actions alone raises the critical question of whether the flexibility mechanisms provided in the Protocol may enable these countries to offset the resulting shortfall. This in turn leads to two different questions:

- Will the rules to be agreed for the flexibility mechanisms permit countries to take full advantage of these mechanisms?
- Will the potential supply of credits under the flexibility mechanisms be adequate to meet the likely shortfalls of countries relative to their Kyoto targets, assuming the answer to the first question is affirmative.

Each of these questions is addressed in following sections of this paper.

US Emissions Outlook Is Key to Global Situation

Because the US is the largest single GHG emitter in the world, and will fall short of its Kyoto target by the largest amount in volumetric terms, some discussion of the US situation is warranted. A detailed estimate of US emissions for 1990, 1995 and 2010 (under the two scenarios described above) is shown in Table 5. The estimates here are generally consistent with those developed by others, including the US government itself.[6]

There are many reasons for high US emissions, both total and per-capita, including the country's vast resource base (which results in a very resource- and energy-intensive economy), demographic factors (low population density in many areas) and climate conditions (some of the largest extremes of both heat and cold in populated areas among all OECD countries). The US is the fourth largest country in the world (after Russia, Canada and China) and the third most populous (after China and India).

Countries rich in fossil-fuel resources, such as Australia, Canada and the US, have economies naturally structured around the exploitation and use of these resources. The US ranks first in the world in coal reserves, 11th in oil reserves and 5th in natural gas reserves. In terms of production of these fuels, its position in the world is even higher: second in coal production, second in oil production and first in gas production. The US is also rich in non-energy mineral resources which require large amounts of energy for their extraction and processing.

In terms of the overall energy mix, oil is the largest source of energy for consumption, nearly 40%. Natural gas accounts for about a quarter of energy use, coal about 22%, nuclear about 8%, hydro about 4% and renewables almost 3%. The shares of both natural gas and renewables have been growing in recent years, while oil and coal have declined.

Rules and Guidelines for the Flexibility Mechanisms

Procedurally, the various flexibility mechanisms contained in the Kyoto Protocol are incomplete. Each of them requires the Conference of the Parties (COP) of the FCCC to take various decisions regarding rules, guidelines, modalities, procedures and so forth, including for monitoring and verification of results.

These issues and several others were discussed at the fourth session of the Conference of the Parties (COP-4) in Buenos Aires on 2-13 November. Not much was able to be agreed in Buenos Aires on any of these issues. Most of the critical questions were deferred for later resolution as set out in the workplan adopted by the COP, with the expectation (or hope) that these issues will be decided by COP-5 or by COP-6 at the latest, that is, within two to three years.

Among the key issues being debated in relation to the flexibility mechanisms are additionality of results from projects and supplementarity of any credits received through the mechanisms relative to domestic actions. These terms might be defined as follows:

- *Additionality*: Any reductions resulting from any project must be additional to those reductions which otherwise would have occurred without the specific intervention in the project for climate change purposes

- *Supplementarity*: Any credits received through any of the flexibility mechanisms must be supplemental to domestic measures to reduce emissions in each Annex B country

Determining additionality is rather difficult. Some have proposed that only actions that are not economic should be considered to result in additional reductions. But under this test there would hardly be any projects funded by the private sector.

In regard to supplementarity, the EU has proposed that a "concrete ceiling" be established that would limit the total amount that each Annex B country could claim as credits from all of the flexibility mechanisms, while others (especially the US) resist any limit on the extent to which credits may be gained through these mechanisms. Both sides are quite firmly fixed in their positions.

Developing countries have mostly been rather skeptical about JI and emissions trading. Since these mechanisms in the Kyoto Protocol are to be used only among industrialized countries, they have shown little interest in rushing to approve any guidelines or rules, especially as the mechanisms could not be used before the beginning of the first commitment period in 2008.

The case is slightly different for the CDM because credits can begin to accumulate already from the year 2000 and because this mechanism would direct donor funding from North to South rather than from West to East. But an "executive board" is to be established to oversee the CDM, and there are likely to be long and elaborate arguments about how this board is to be structured, how decisions are to be taken, and so forth, if the earlier experience with the establishment of the Global Environment Facility (GEF) is any guide.

There are also questions about what group or groups should function as the "operational entities" that are to be designated to certify results under the CDM. Developing countries have taken the position that no entity that provides funds itself should also be able to certify the results of projects. This would thus rule out the World Bank, the GEF and various other entities. These and other questions related to the CDM were not really discussed at COP-4 and must be addressed in coming years.

Requirements for and Availability of Credits Under Flexibility Mechanisms

Assuming the Parties to the FCCC and the Protocol ever agree on the rules and guidelines for the flexibility mechanisms, one then comes back to the question raised earlier whether these mechanisms can enable the Annex B countries to meet the Kyoto targets that appear unachievable through domestic actions alone. The discussion and analysis below assumes these rules are agreed and place very few if any serious restrictions on the use of any credits that may be obtained through the mechanisms. This is probably unlikely, based on developments thus far, but is simply a working assumption for purposes of addressing the second basic question regarding the use of the mechanisms.

First, the demand and supply situation within Annex B is assessed using the emissions estimates presented above. For each OECD country, the projected emissions of six gases are compared with the limits that would be imposed on these emissions by Annex B (or in the case of EU countries, with the limits agreed by EU ministers in June 1998 allocating the burden-sharing among EU Member States under the EU "bubble"). The potential demand is measured by the degree to which the OECD countries fall short of the Kyoto targets under each scenario for 2010 emissions.

Based on the preliminary estimates for 2010 shown in Table 2, it appears that the OECD countries will have a potential demand for credits of between 1.7 and 3.0 billion tonnes of CO_2 equivalent, as shown in Table 3 (or about 480 to 810 tonnes of carbon equivalent, as shown in Table 3A). The low end of this range corresponds to the Pain Threshold Scenario, under which each of these countries takes every reasonable economically and politically feasible measure within its borders first before looking for credits from outside.[7]

The largest part of the OECD demand for credits, about 1.2 of the 1.7 billion tonnes in the low estimate and about 1.8 of the 3.0 billion tonnes in the high estimate, is from the US. These numbers may even be on the low side, unless trends in the transport sector change rather significantly from the current pattern. The biggest issue affecting US emissions in the next 10 years is the restructuring and opening up of electricity markets, and this could affect emissions either way from the estimates shown in Tables 1, 2 and 3.

Against these estimates of potential demand for credits, one must look at the potential supply of credits from non-OECD Annex B countries. As with OECD countries, the supply is measured by the degree to which emissions for these countries may be below the targets set for them in Annex B of the Protocol. This is shown in Table 4 to range between about 250 million and slightly less than 1.3 billion tonnes of CO_2 equivalent (about 66 to 350 million tonnes of carbon equivalent, as shown in Table 4A).

The estimates of 2010 emissions were developed on a gas-by-gas and sector-by-sector basis, as with OECD countries, although there is a good deal more uncertainty about some of these estimates. The uncertainty arises both from the poor quality of the emissions data for 1990 and 1995 (where data exists at all) and from the instability in the economic situation of some of these countries, especially Russia.

As noted above, the scenarios used for the non-OECD Annex B countries are somewhat different from the two scenarios described above for OECD countries. The high number corresponds to a scenario where these countries fail to get their economies up and running by 2010 and are willing to trade away the "hot air" that results. The lower estimate assumes most of these countries have progressed reasonably well along the transition path from centrally planned to market economies by 2010, and thus have much less, if any, surplus emission allowances to sell or trade to OECD countries.

Russia Is Key to Credit Supply Outlook

As seen from Table 4, most of the potential surplus is in Russia, about 880 million of the roughly 1.3 billion tonnes in the low economic growth/high surplus case and about 190 of the 250 million tonnes in the higher growth/lower surplus case. Thus, Russia holds the key to any significant supply of credits within the Annex B countries. Table 6 provides details of estimates of Russian emissions for 1990, 1995 and 2010 relative to both the high growth and low growth scenarios. No estimates are given for HFCs, PFCs or SF_6, but these gases generally amount to 2% or less of most countries' emissions. If reliable estimates of these emissions were available, their effect would probably be to reduce slightly the amount of surplus reductions Russia might otherwise have available.

There is obviously considerable uncertainty in any estimates of future Russian emissions, given the dependence of such emissions on economic conditions and the current unstable situation affecting the Russian economy. However, the estimates shown in Table 6 are generally consistent with, although somewhat lower than, those made by the Russian government.[8]

However, the Russian government has already indicated publicly[9] that it will not simply trade away its surplus but will make credits available only through projects, that is, JI projects under Article 6 of the Protocol. Direct trading of emissions allowances would not be considered until sometime after the year 2013.

Several considerations help to explain why Russia will favor projects rather than broad-scale emissions trading in the near term, including:

- Domestic politics: There are at least three distinct camps within Russia regarding the flexibility mechanisms: (1) Reformers, who believe any engagement in international markets is likely to be beneficial to Russia, especially if it brings hard currency earnings; (2) Old-line Communists, who believe markets can not be trusted and the State should retain and control all assets for the benefit of the Russian people; (3) Pragmatists, who see the potential benefits of Western investments in Russia (through projects) and also the dangers of selling overall emission "allowances" based on "hot air." The second and third group are both wary of emissions trading because of negative experiences with privatization of State-held assets. Moreover, the current political situation also favors the second group.

- Longer-term hedging: Russia will want to bank some of the "hot air" for its own use in later commitment periods in light of the upward trend of its own emissions over the longer term.

- Administration: Russia has had serious difficulty organizing its domestic economy in the past few years. While climate-related activities could be an important source of hard-currency earnings if the Kyoto Protocol ever enters into force, there are other higher-priority projects more directly related to near-term economic performance that will occupy officials' attention.

- Inexperience: Russia has had relatively little experience in trading in international markets outside of certain commodities,[10] and is cautious about venturing too quickly into a market that does not even exist yet. The fact that no one has ever traded emission allowances internationally gives further support for a "wait-and-see" attitude.

Credit Supply Will Be Project-Based and Will Be Limited

Developing countries do not participate in trading because they do not have emission limits. And no major developing countries (China, India, Brazil, etc.) will take on voluntary targets in this time frame because they will not be willing to limit their economic growth. For countries in the mid to later stages of rapid industrialization there is a high correlation between energy consumption (which means CO_2 emissions) and GDP. This is somewhat less the case for mature economies like the US, although there is still a correlation as long as the manufacturing sector contributes a significant portion of GDP.

China's CO_2 emissions alone grew by 21% (about 600 million tonnes) between 1990 and 1995, while India's grew by 25% (about 200 million tonnes). Thus, to have surplus emissions available to trade in 2010, China and India would have to have "caps" on their emissions that would be higher than these rates of growth. To cover the US requirement for credits alone, the surplus available in 2010 from developing countries would need to be something like 1.5 billion tonnes of CO_2.

The international reaction to developing countries pledging to hold their emissions increases to rates that imply at least a doubling of their 1990 emissions by 2010 to cover their own anticipated growth plus another 1.5 billion tonnes to trade to the US would be overwhelmingly negative. And in any case the major developing countries have given every indication that they won't consider any limit on their emissions.

So that leaves only projects in the central and eastern European countries under Article 6 of the Protocol (joint implementation) or in the developing countries under Article 12 of the Protocol (Clean Development Mechanism). One can't begin to generate enough credits through projects to cover the OECD deficits.

Project-based credit supply is inherently much less than trading-based supply. Each project must be organized, certified for additionality, and meet all the other criteria still to be defined. This means delays in starting and limited volumes of credits once the projects are implemented. A project-based credit supply from non-OECD Annex B (through JI) is probably only about 100 to at most 300 million tonnes, or about 10% of the demand from the OECD countries.

The analysis of potential availability of credits from the flexibility mechanisms must also consider the availability of credits from countries outside Annex B through the Clean Development Mechanism (CDM). These credits will only be from actual projects in these countries, which inherently limits the possible supply. Moreover, credits from each project must be certified in accordance with various guidelines and criteria, as discussed above.

Credits from the CDM will be slow in coming not only because of the need to agree on guidelines, etc., but also because of a likely long debate over how the CDM governance is to be structured. The issues of additionality and supplementarity will further limit the overall magnitude of these credits, once they finally may become available in principle. A prudent estimate is that 200 to 300 million tonnes would be a likely upper end of the range for CDM credits by 2010.

A further indication of the difficulty of achieving large emission reduction credits from individual projects is provided by the FCCC secretariat paper distributed in October 1998 that lists all projects reported by countries on "activities implemented jointly" under the JI pilot phase.[11] The compilation includes projects in all countries, both in the central and eastern European countries listed in Annex B and also in developing countries.

The emission reductions reported over the lifetimes of the 95 projects amounts to about 160 million tonnes of CO_2 equivalent, as shown in Table 7. (Actually, the data is inadequate for two projects so that the analysis covers only 93 projects.) On an annual basis (dividing the tonnage for each project by the lifetime and summing over all projects), the projects listed in the secretariat document amount to 7 million tonnes per year, in total.

Current indications are that forestry projects in developing countries, or at least forest preservation projects, are not likely to be credited in the initial phase of the CDM. If one excludes the forest preservation projects, the annual contribution is 3.8 million tonnes a year; if all forest projects in developing countries are excluded (as proposed by the Group of 77 and China), then the annual contribution from the remaining 80 projects falls to 3.5 million tonnes a year.

Most of the projects are energy projects. The average annual emission reduction per project for the 80 non-forest projects is about 43 thousand tonnes. If this is at all indicative of what individual projects can deliver, then to cover the 1.7 to 3.0 billion tonne deficit of the OECD countries would require between 40,000 and 70,000 projects.

These numbers may be on the pessimistic side and some undoubtedly will argue that in a situation where the Protocol had entered into force, bigger projects will be found. But even if one makes much more optimistic assumptions about such projects, it is difficult to see how any reasonable number of projects in the real world can possibly cover the OECD country deficits.[12] And there is the further issue of the cost of funding these projects.

The analysis presented here has not addressed the question of costs. Any future international market for emission credits is going to be dominated by the largest buyers (in this case the US) and the largest sellers (most likely Russia, at least in the near term). In such a situation where the demand for credits far exceeds the supply, the price of such credits is likely to rise to close to the marginal cost of emissions reductions for the largest buyer of credits. One may conclude from this that the cost to the US of achieving the Kyoto target with full use of the flexibility mechanisms is likely to be only slightly discounted below the cost that would be incurred without the mechanisms.

Summary of Emissions Credit Supply and Demand Outlook

A realistic project-based credit supply from non-OECD Annex B (through JI) is probably only about 100 to at most 300 million tonnes, or about 10% of the demand from the OECD countries. In addition, the maximum likely range for CDM credits from developing countries by 2010 is at most 200 to 300 million tonnes. These two ranges are not additive, because donors will need to choose in some cases between potential projects either in eastern Europe or in developing countries.

Overall, taking all these considerations into account, the total supply of credits from all three mechanisms is probably only about 200 to 500 million tonnes, at most. Most of the credits would come from projects, either JI under Article 6 or CDM under Article 12. Of the total, emissions trading under Article 17 is expected to contribute very little in this time frame, since Russia has already indicated it is unlikely to participate until later.

Even this range of credits from JI and CDM is quite significant. It implies perhaps 3,000 to more than 10,000 projects, if the information available to date about average project size is any indication. But when this supply estimate is compared with the demand estimates shown in Table 3, this still leaves the US and other OECD countries far short of their Kyoto targets. If the US, for example, were to acquire the entire global supply of credits, this would cover less than half its needs in the best case and less that 10% of its needs in the worst case.

Outlook for Ratification & Entry Into Force of the Protocol

As of mid-April 1999, 84 countries had signed the Protocol during the one year it was open for signature but only eight had ratified. All of those ratifying were developing countries,[13] which have no significant obligations under the treaty. Signature is a political gesture of intent to ratify at some point but carries no legal obligations. Only ratification or accession to a treaty signifies any legal commitment, and even after a country ratifies the treaty the legal obligations are not activated until the treaty actually enters into force.

Article 25 of the Protocol specifies the conditions for entry into force of the Protocol. As noted earlier, the Protocol will enter into force 90 days after at least 55 countries have ratified or acceded to the Protocol, provided that these countries account for at least 55% of the CO_2 emissions in 1990 of the countries listed in Annex I of the UN Framework Convention on Climate Change. Annex I is almost the same as Annex B to the Protocol, although there are some differences.

Although a number of countries have indicated their support by signing the Protocol, there is not likely to be a big rush toward ratification. Many industrialized countries will hang back until they see what other countries are going to do. Since there are no new commitments for developing countries in the Protocol, some of these countries may ratify early (e.g., small island states), but this will have no effect on the CO_2 emissions requirement that is calculated only in terms of industrialized countries.

In terms of key countries, the US is the major question mark. The projections for the US shown in Tables 2 and 3 indicate a major shortfall relative to its Kyoto target, and as noted above, the availability of credits through the flexibility mechanisms is estimated to be far too small to compensate for this shortfall, regardless of how permissive the rules may turn out to be. This forces the White House into a difficult position in relation to the US Senate, which must give its advice and consent before the US can ratify the treaty. The Senate has already indicated significant concerns regarding the possible economic impacts of the treaty.[14]

The US accounted for about 35% of Annex I CO_2 emissions in 1990, which alone is not sufficient to block entry into force of the Kyoto Protocol. However, a number of other countries are very likely to wait until the US ratifies before they do so, particularly countries with strong trade and other economic ties to the US such as Canada and Japan.

The 15 Member States of the European Union must ratify all at the same time as a group because they intend to be treated as a block or "bubble" under the provisions of Article 4. If any Member State ratifies alone, it is subject to the 8% reduction target that is listed for each EU country in Annex B and only a minority of EU countries are likely to be able to reach such a target. This means that if any EU country holds back, then all 15 countries are effectively held back from ratifying, and some EU Member States may wish to wait in order to put pressure on the US.

The likely consequence of this dynamic is that the Kyoto Protocol is unlikely to enter into force for several years, perhaps not before 2004 or 2005. But by that time most countries will be so far along the emissions curve corresponding to the Trend Scenario that meeting the targets will be impossible for almost all of them.

This creates a certain dilemma, since the only way to achieve sufficient ratifications to trigger entry into force appears to be a renegotiation of the targets to bring them more in line with reality. But the targets can not be amended except by the Parties to the Protocol after it has entered into force. One way around this dilemma might be negotiation of a separate legal instrument (treaty) that would be ratified together with the Protocol, would enter into force simultaneously with the Protocol, and would modify whatever provisions of the Protocol were necessary in order to allow key countries to ratify.

The new instrument would be negotiated sometime between 2003 and 2006. Its provisions might include:

- A realistic set of differentiated targets for the Annex B countries, much more accurately reflecting national circumstances and what might actually be achieved by each country.
- A new first commitment period, say from 2013 to 2017 at the earliest. The original 2008-2012 period would already be too soon to get agreement on targets that reflected any significant change from then current emission trends.
- A new base reference period, possibly a multi-year average of 1998-2002, which would be much more realistic than continuing to refer back to 1990 and could also adapt for year-to-year variations due to weather, electricity trade and other factors.
- The inclusion in Annex B of some newly industrialized countries such as Korea and Mexico and maybe a few others, provided the targets were set on a reasonable and realistic basis.
- The clarification of the rules, guidelines, criteria, etc., for the flexibility mechanisms, and establishment of the governance for the Executive Board of the CDM.
- A longer-term collective target for 2025 or later that would send a signal for development of new technologies and would be conditional on evidence that such technologies were actually feasible (technically, economically and politically).

Such an agreement would correct the shortcomings of the Kyoto Protocol and would establish a more reasonable and stable process for responding to global climate change on an international level.

TABLE 1: OECD EMISSIONS, CO2 FROM FUEL CONSUMPTION
(MILLION TONNES CO2)

COUNTRY	1990	1995	% 1990	2010 TREND	% 1990	2010 PAIN	% 1990
Austria	59.39	59.98	0.99	66.36	11.74	60.46	1.80
Belgium	109.33	117.12	7.13	129.55	18.49	120.88	10.56
Denmark	53.25	60.53	13.67	55.25	3.76	45.40	-14.74
Finland	53.68	54.40	1.34	74.23	38.28	64.75	20.62
France	378.03	362.02	-4.24	395.95	4.74	376.30	-0.46
Germany	982.33	884.41	-9.97	943.50	-3.95	848.00	-13.67
Greece	72.46	76.62	5.74	101.20	39.66	96.50	33.18
Ireland	33.24	34.86	4.87	43.25	30.11	41.85	25.90
Italy	409.29	423.82	3.55	460.40	12.49	444.40	8.58
Luxembourg	10.86	8.94	-17.68	10.18	-6.26	9.38	-13.63
Netherlands	161.50	178.83	10.73	201.48	24.76	189.42	17.29
Portugal	41.58	50.88	22.37	61.35	47.55	54.73	31.63
Spain	215.92	246.98	14.39	272.20	26.07	254.80	18.01
Sweden	52.77	56.12	6.35	59.76	13.25	57.15	8.30
United Kingdom	584.05	564.84	-3.29	606.00	3.76	545.10	-6.67
EU-15	3,217.68	3,180.35	-1.16	3 480.66	8.17	3 209.12	-0.27
Australia	264.80	285.99	8.00	354.65	33.93	340.55	28.61
Canada	431.05	470.80	9.22	547.60	27.04	521.50	20.98
Czech Republic	156.99	120.40	-23.31	169.55	8.00	149.15	-4.99
Hungary	68.06	57.77	-15.12	80.62	18.45	71.17	4.57
Iceland	2.38	2.34	-1.68	3.15	32.35	3.12	31.09
Japan	1,065.38	1,150.94	8.03	1 271.40	19.34	1 140.80	7.08
New Zealand	25.25	29.31	16.08	31.15	23.37	28.70	13.66
Norway	31.47	34.16	8.55	43.15	37.11	41.63	32.28
Poland	350.49	336.11	-4.10	421.90	20.37	376.80	7.51
Switzerland	44.29	41.96	-5.26	49.35	11.42	45.51	2.75
United States	4,907.51	5,228.52	6.54	6 192.50	26.18	5 667.50	15.49
OECD Total	10,565.35	10,938.65	3.53	12 645.68	19.69	11 595.55	9.75

Source: Reinstein & Associates International estimates

TABLE 1A: OECD EMISSIONS: CO2 FROM FUEL CONSUMPTION
(MILLION TONNES CARBON)

COUNTRY	1990	1995	% 1990	2010 TREND	% 1990	2010 PAIN	% 1990
Austria	16.20	16.36	0.99	18.10	11.74	16.49	1.80
Belgium	29.82	31.94	7.13	35.33	18.49	32.97	10.56
Denmark	14.52	16.51	13.67	15.07	3.76	12.38	-14.74
Finland	14.64	14.84	1.34	20.24	38.28	17.66	20.62
France	103.10	98.73	-4.24	107.99	4.74	102.63	-0.46
Germany	267.91	241.20	-9.97	257.32	-3.95	231.27	-13.67
Greece	19.76	20.90	5.74	27.60	39.66	26.32	33.18
Ireland	9.07	9.51	4.87	11.80	30.11	11.41	25.90
Italy	111.62	115.59	3.55	125.56	12.49	121.20	8.58
Luxembourg	2.96	2.44	-17.68	2.78	-6.26	2.56	-13.63
Netherlands	44.05	48.77	10.73	54.95	24.76	51.66	17.29
Portugal	11.34	13.88	22.37	16.73	47.55	14.93	31.63
Spain	58.89	67.36	14.39	74.24	26.07	69.49	18.01
Sweden	14.39	15.31	6.35	16.30	13.25	15.59	8.30
United Kingdom	159.29	154.05	-3.29	165.27	3.76	148.66	-6.67
EU-15	877.55	867.37	-1.16	949.27	8.17	875.21	-0.27
Australia	72.22	78.00	8.00	96.72	33.93	92.88	28.61
Canada	117.56	128.40	9.22	149.35	27.04	142.23	20.98
Czech Republic	42.82	32.84	-23.31	46.24	8.00	40.68	-4.99
Hungary	18.56	15.76	-15.12	21.99	18.45	19.41	4.57
Iceland	0.65	0.64	-1.68	0.86	32.35	0.85	31.09
Japan	290.56	313.89	8.03	346.75	19.34	311.13	7.08
New Zealand	6.89	7.99	16.08	8.50	23.37	7.83	13.66
Norway	8.58	9.32	8.55	11.77	37.11	11.35	32.28
Poland	95.59	91.67	-4.10	115.06	20.37	102.76	7.51
Switzerland	12.08	11.44	-5.26	13.46	11.42	12.41	2.75
United States	1,338.41	1,425.96	6.54	1,688.86	26.18	1,545.68	15.49
OECD Total	2,881.46	2,983.27	3.53	3,448.82	19.69	3,162.42	9.75

Source: Reinstein & Associates International estimates

TABLE 2: OECD EMISSIONS, SIX KYOTO PROTOCOL GASES
(MILLION TONNES CO2 EQUIVALENT)

COUNTRY	1990	1995	% 1990	2010 TREND	% 1990/95	2010 PAIN	% 1990/95
Austria	80.76	81.84	1.33	88.16	6.98	81.03	-1.67
Belgium	142.91	153.15	7.16	165.76	15.51	155.91	8.65
Denmark	74.19	82.30	10.94	72.19	-3.02	60.10	-19.26
Finland	65.73	66.14	0.62	85.71	30.06	74.82	13.53
France	527.52	509.62	-3.39	548.30	4.41	521.90	-0.62
Germany	1,208.16	1,090.19	-9.76	1,157.32	-4.36	1,048.26	-13.37
Greece	94.87	99.50	4.88	122.99	29.64	117.27	23.61
Ireland	61.07	61.80	1.20	71.42	16.95	68.48	12.15
Italy	542.63	556.61	2.58	593.61	9.28	568.78	4.71
Luxembourg	12.17	10.06	-17.36	11.12	-8.60	10.29	-15.45
Netherlands	212.06	234.49	10.58	257.89	19.61	240.93	11.75
Portugal	66.75	63.86	-4.33	86.35	29.36	78.33	17.34
Spain	317.73	350.45	10.30	380.31	18.78	355.41	11.00
Sweden	67.90	71.74	5.66	76.33	11.64	73.09	6.91
United Kingdom	750.14	708.88	-5.50	737.60	-1.85	665.44	-11.45
EU-15	4,224.57	4,140.63	-1.99	4,455.06	5.19	4,119.99	-2.72
Australia	412.57	432.02	4.71	505.18	23.47	483.92	18.27
Canada	570.92	629.64	10.29	722.49	26.64	684.56	19.99
Czech Republic	189.11	146.72	-22.42	199.40	5.44	176.64	-6.60
Hungary	93.81	77.39	-17.50	103.37	10.19	92.88	-0.99
Iceland	3.59	3.34	-6.95	4.26	27.28	4.20	25.42
Japan	1,264.14	1,395.99	10.43	1,529.86	17.57	1,369.07	5.22
New Zealand	79.41	81.87	3.10	84.49	6.69	81.01	2.30
Norway	58.54	59.63	1.86	68.93	22.97	66.52	18.66
Poland	451.78	412.92	-8.60	504.65	11.70	455.43	0.81
Switzerland	57.72	55.60	-3.66	63.04	7.34	58.54	-0.33
United States	5,809.94	6,230.52	7.24	7,207.25	23.02	6,636.01	13.27
OECD Total	13,216.09	13,666.28	3.41	15,447.96	16.89	14,228.75	7.66

Source: Reinstein & Associates International estimates

TABLE 2A: OECD EMISSIONS: SIX KYOTO PROTOCOL GASES
(MILLION TONNES CARBON EQUIVALENT)

COUNTRY	1990	1995	% 1990	2010 TREND	% 1990/95	2010 PAIN	% 1990/95
Austria	22.03	22.32	1.33	24.04	6.98	22.10	-1.67
Belgium	38.98	41.77	7.16	45.21	15.51	42.52	8.65
Denmark	20.23	22.45	10.94	19.69	-3.02	16.39	-19.26
Finland	17.93	18.04	0.62	23.38	30.06	20.40	13.53
France	143.87	138.99	-3.39	149.54	4.41	142.34	-0.62
Germany	329.50	297.33	-9.76	315.63	-4.36	285.89	-13.37
Greece	25.87	27.14	4.88	33.54	29.64	31.98	23.61
Ireland	16.65	16.85	1.20	19.48	16.95	18.68	12.15
Italy	147.99	151.80	2.58	161.89	9.28	155.12	4.71
Luxembourg	3.32	2.74	-17.36	3.03	-8.60	2.81	-15.45
Netherlands	57.83	63.95	10.58	70.33	19.61	65.71	11.75
Portugal	18.20	17.42	-4.33	23.55	29.36	21.36	17.34
Spain	86.65	95.58	10.30	103.72	18.78	96.93	11.00
Sweden	18.52	19.56	5.66	20.82	11.64	19.93	6.91
United Kingdom	204.58	193.33	-5.50	201.16	-1.85	181.48	-11.45
EU-15	1,152.16	1,129.26	-1.99	1,215.02	5.19	1,123.63	-2.72
Australia	112.52	117.82	4.71	137.78	23.47	131.98	18.27
Canada	155.70	171.72	10.29	197.04	26.64	186.70	19.99
Czech Republic	51.58	40.02	-22.42	54.38	5.44	48.17	-6.60
Hungary	25.58	21.11	-17.50	28.19	10.19	25.33	-0.99
Iceland	0.98	0.91	-6.95	1.16	27.28	1.14	25.42
Japan	344.77	380.72	10.43	417.23	17.57	373.38	5.22
New Zealand	21.66	22.33	3.10	23.04	6.69	22.09	2.30
Norway	15.97	16.26	1.86	18.80	22.97	18.14	18.66
Poland	123.21	112.62	-8.60	137.63	11.70	124.21	0.81
Switzerland	15.74	15.16	-3.66	17.19	7.34	15.96	-0.33
United States	1,584.53	1,699.23	7.24	1,965.61	23.02	1,809.82	13.27
OECD Total	3,604.39	3,727.17	3.41	4,213.08	16.89	3,880.57	7.66

Source: Reinstein & Associates International estimates

TABLE 3: POSSIBLE OECD DEMAND FOR CREDITS FROM FLEXIBILITY MECHANISMS (MILLION TONNES CO2 EQUIVALENT)

COUNTRY	1990 BASE	KYOTO*	TARGET	2010 TREND	VS. TARGET	2010 PAIN	VS. TARGET
Austria	82.41	0.870	71.70	88.16	-16.47	81.03	-9.34
Belgium	143.49	0.925	132.73	165.76	-33.02	155.91	-23.18
Denmark	74.43	0.790	58.80	72.18	-13.38	60.10	-1.30
Finland	65.90	1.000	65.90	85.71	-19.81	74.82	-8.92
France	525.17	1.000	525.17	548.30	-23.14	521.90	3.27
Germany	1,210.09	0.790	955.97	1,157.32	-201.35	1,048.26	-92.29
Greece	94.87	1.250	118.58	122.99	-4.40	117.27	1.32
Ireland	61.07	1.130	69.00	71.42	-2.41	68.48	0.52
Italy	543.20	0.935	507.89	593.61	-85.72	568.78	-60.89
Luxembourg	12.17	0.720	8.76	11.12	-2.36	10.29	-1.53
Netherlands	215.61	0.940	202.67	257.89	-55.22	240.93	-38.26
Portugal	66.75	1.270	84.77	86.35	-1.58	78.32	6.45
Spain	320.19	1.150	368.22	380.31	-12.09	355.41	12.81
Sweden	68.37	1.040	71.10	76.33	-5.22	73.09	-1.99
UK	751.51	0.875	657.57	737.60	-80.03	665.44	-7.87
EU-15	4,235.22	0.920	3,896.40	4,455.06	-558.66	4,119.99	-223.58
Australia	409.16	1.080	441.89	505.18	-63.28	483.92	-42.03
Canada	570.52	0.940	536.29	722.48	-186.20	684.56	-148.27
Czech Rep.	189.12	0.920	173.99	199.40	-25.41	176.64	-2.65
Hungary	101.62	0.940	95.52	103.37	-7.85	92.88	2.64
Iceland	3.34	1.100	3.68	4.26	-0.58	4.19	-0.52
Japan	1,301.21	0.940	1,223.14	1,529.86	-306.72	1,369.07	-145.93
New Zealand	79.19	1.000	79.19	84.49	-5.30	81.01	-1.82
Norway	56.06	1.010	56.62	68.93	-12.32	66.52	-9.90
Poland	501.18	0.940	471.11	504.65	-33.54	455.43	15.68
Switzerland	58.73	0.920	54.03	63.04	-9.01	58.54	-4.51
United States	5,858.53	0.930	5,448.43	7,207.25	-1,758.82	6,636.01	-1,187.58
OECD Total	13,363.87	0.934	12,480.28	15,447.96	-2,967.68	14,228.75	-1,748.47

Source: Reinstein & Associates International estimates

Base year is 1990 for CO_2, CH_4 and N_2O, 1995 for HFCs, PFCs and SF_6; Hungary uses average of 1985-87 as base and Poland uses 1988 as base, in accordance with FCCC Article 4.6.
*EU percentages are as specified in June 1998 EU Council Conclusions rather than in Annex B

TABLE 3A: POSSIBLE DEMAND FOR CREDITS FROM FLEXIBILITY MECHANISMS (MILLION TONNES CARBON EQUIVALENT)

COUNTRY	1990 BASE	KYOTO*	TARGET	2010 TREND	VS. TARGET	2010 PAIN	VS
Austria	22.48	0.870	19.55	24.04	-4.49	22.10	-2.55
Belgium	39.13	0.925	36.20	45.21	-9.01	42.52	-6.32
Denmark	20.30	0.790	16.04	19.69	-3.65	16.39	-0.35
Finland	17.97	1.000	17.97	23.38	-5.40	20.40	-2.43
France	143.23	1.000	143.23	149.54	-6.31	142.34	0.89
Germany	330.02	0.790	260.72	315.63	-54.91	285.89	-25.17
Greece	25.87	1.250	32.34	33.54	-1.20	31.98	0.36
Ireland	16.65	1.130	18.82	19.48	-0.66	18.68	0.14
Italy	148.15	0.935	138.52	161.89	-23.38	155.12	-16.61
Luxembourg	3.32	0.720	2.39	3.03	-0.64	2.81	-0.42
Netherlands	58.80	0.940	55.27	70.33	-15.06	65.71	-10.44
Portugal	18.20	1.270	23.12	23.55	-0.43	21.36	1.76
Spain	87.32	1.150	100.42	103.72	-3.30	96.93	3.49
Sweden	18.65	1.040	19.39	20.82	-1.42	19.93	-0.54
United Kingdom	204.96	0.875	179.34	201.16	-21.83	181.48	-2.15
EU-15	1,155.06	0.920	1,062.66	1,215.02	-152.36	1,123.63	-60.98
Australia	111.59	1.080	120.52	137.78	-17.26	131.98	-11.46
Canada	155.60	0.940	146.26	197.04	-50.78	186.70	-40.44
Czech Republic	51.58	0.920	47.45	54.38	-6.93	48.17	-0.72
Hungary	27.71	0.940	26.05	28.19	-2.14	25.33	0.72
Iceland	0.91	1.100	1.00	1.16	-0.16	1.14	-0.14
Japan	354.87	0.940	333.58	417.23	-83.65	373.38	-39.80
New Zealand	21.60	1.000	21.60	23.04	-1.45	22.09	-0.50
Norway	15.29	1.010	15.44	18.80	-3.36	18.14	-2.70
Poland	136.69	0.940	128.48	137.63	-9.15	124.21	4.28
Switzerland	16.02	0.920	14.74	17.19	-2.46	15.96	-1.23
United States	1,597.78	0.930	1,485.94	1,965.61	-479.68	1,809.82	-323.89
OECD Total	3,644.69	0.934	3,403.71	4,213.08	-809.37	3,880.57	-476.85

Source: Reinstein & Associates International estimates

Base year is 1990 for CO_2, CH_4 and N_2O, 1995 for HFCs, PFCs and SF_6; Hungary uses average of 1985-87 as base and Poland uses 1988 as base, in accordance with FCCC Article 4.6.
*EU percentages are as specified in June 1998 EU Council Conclusions rather than in Annex B

TABLE 4: POSSIBLE EMISSIONS CREDITS FROM NON-OECD ANNEX B COUNTRIES (MILLION TONNES CO2 EQUIVALENT)

COUNTRY	1990 BASE	KYOTO	TARGET	2010 HIGH	VS. TARGET	2010 LOW	VS. TARGET
Bulgaria	125.77	0.92	115.71	108.06	7.65	87.61	28.10
Croatia	17.28	0.95	16.42	19.73	-3.31	17.52	-1.10
Estonia	41.08	0.92	37.80	36.17	1.62	26.49	11.31
Latvia	32.85	0.92	30.23	28.93	1.30	19.43	10.80
Lithuania	45.18	0.92	41.57	50.55	-8.98	29.19	12.38
Romania	246.78	0.92	227.03	238.58	-11.54	194.49	32.54
Russia	3,038.43	1.00	3,038.43	2,847.27	191.16	2,161.00	877.44
Slovakia	70.49	0.92	64.85	70.55	-5.70	56.98	7.87
Slovenia	18.56	0.92	17.07	20.33	-3.26	18.05	-0.98
Ukraine	916.30	1.00	916.30	836.78	79.52	609.82	306.48
TOTAL	4,552.73		4,505.41	4,256.95	248.46	3,220.57	1,284.84

Source: Reinstein & Associates International estimates

Base year is 1990 for CO_2, CH_4 and N_2O, 1995 for HFCs, PFCs and SF_6; Bulgaria uses 1988 as base, in accordance with FCCC Article 4.6.

TABLE 4A: POSSIBLE EMISSIONS CREDITS FROM NON-OECD ANNEX B COUNTRIES (MILLION TONNES CARBON EQUIVALENT)

COUNTRY	1990	KYOTO	HIGH	SURPLUS	LOW	SURPLUS
Bulgaria	32.40	29.81	29.47	0.34	23.89	5.91
Croatia	4.71	4.48	5.38	-0.90	4.78	-0.30
Estonia	11.20	10.31	9.87	0.44	7.22	3.08
Latvia	8.96	8.24	7.89	0.35	5.30	2.94
Lithuania	12.32	11.34	13.79	-2.45	7.96	3.38
Romania	67.30	61.92	65.07	-3.15	53.04	8.88
Russia	828.66	828.66	776.53	52.14	589.36	239.30
Slovakia	19.22	17.69	19.24	-1.55	15.54	2.15
Slovenia	5.06	4.66	5.54	-0.89	4.92	-0.27
Ukraine	249.90	249.90	228.21	21.69	166.31	83.59
TOTAL	1,239.75	1,227.00	1,160.99	66.01	878.34	348.66

Source: Reinstein & Associates International estimates

Base year is 1990 for CO_2, CH_4 and N_2O, 1995 for HFCs, PFCs and SF_6; Bulgaria uses 1988 as base, in accordance with FCCC Article 4.6.

TABLE 5: EMISSIONS OUTLOOK FOR UNITED STATES
(MILLION TONNES CO2 EQUIVALENT)

	1990 IEA	1995 IEA	2010 TREND	TREND %90/95	2010 PAIN	PAIN %90/95
Land area (square km)	9,166,600	9,166,600	9,166,600		9,166,600	
Population (thousands)	249,924	263,060	297,486	19.03	297,486	19.03
Population density	27.26	28.70	32.45		32.45	
GDP (billion USD, PPP basis)	5,489.60	6,149.52				
GDP per capita (PPP basis)	21,965	23,377				
TPES including combust. renew.	1,915.00	2,078.27				
Renewable %	3.25	3.40				
TPES, million TOE	1,852.74	2,007.69				
TPES per capita (TOE per person)	7.41	7.63				
TPES per GDP (TOE per M USD)	337.5	326.5				
Energy CO2 per capita	19.64	19.88				
Energy CO2 per GDP	893.97	850.23				
Energy CO2 per TPES	2.65	2.60				
Utilities--CO2 from coal	1,517.08	1,614.77	2,000.00	31.83	1,600.00	5.47
Utilities--CO2 from oil	87.70	48.78	50.00	-42.99	50.00	-42.99
Utilities--CO2 from gas	152.66	176.31	250.00	63.76	400.00	162.02
Utilities--total CO2	1,757.43	1,839.86	2,300.00	30.87	2,050.00	16.65
Utilities--coal % of utility CO2	86.32	87.77	86.96		78.05	
Utilities--oil % of utility CO2	4.99	2.65	2.17		2.44	
Utilities--gas % of utility CO2	8.69	9.58	10.87		19.51	
Utilities--coal % of total CO2	30.91	30.88	32.30		28.23	
Utilities--oil % of total CO2	1.79	0.93	0.81		0.88	
Utilities--gas % of total CO2	3.11	3.37	4.04		7.06	
Utilities--all fuels % of total CO2	35.81	35.19	37.14		36.17	
Auto-producers--CO2 from coal		95.38	80.00		50.00	
Auto-producers--CO2 from oil						
Auto-producers--CO2 from gas		123.60	140.00		150.00	
Auto-producers--total CO2		218.97	220.00		200.00	
Auto-producers--coal %	0.00	1.82	1.29		0.88	
Auto-producers--oil %	0.00	0.00	0.00		0.00	
Auto-producers--gas %	0.00	2.36	2.26		2.65	
Auto-producers--all fuels %	0.00	4.19	3.55		3.53	
Energy industry--CO2 from coal	2.58	1.57	1.50	-41.86	1.50	-41.86
Energy industry--CO2 from oil	164.81	158.23	170.00	3.15	160.00	-2.92
Energy industry--CO2 from gas	104.23	107.96	115.00	10.33	120.00	15.13
Energy industry--total CO2	271.62	267.75	286.50	5.48	281.50	3.64
Energy industry--coal %	0.05	0.03	0.02		0.03	
Energy industry--oil %	3.36	3.03	2.75		2.82	

Energy industry--gas %	2.12	2.06	1.86		2.12	
Energy industry--all fuels %	5.53	5.12	4.63		4.97	
All energy industries--total CO2	2,029.05	2,326.58	2,806.50	38.32	2,531.50	24.76
All energy industries--all fuels %	41.35	44.50	45.32		44.67	
Manuf. & construc.--CO2 from coal	249.63	165.83	200.00	-19.88	170.00	-31.90
Manuf. & construc.--CO2 from oil	203.78	186.33	210.00	3.05	190.00	-6.76
Manuf. & construc.--CO2 from gas	346.32	299.08	370.00	6.84	350.00	1.06
Manuf. & construc.--total CO2	799.73	651.25	780.00	-2.47	710.00	-11.22
Manuf. & construc.--coal %	5.09	3.17	3.23		3.00	
Manuf. & construc.--oil %	4.15	3.56	3.39		3.35	
Manuf. & construc.--gas %	7.06	5.72	5.98		6.18	
Manuf. & construc.--all fuels %	16.30	12.46	12.60		12.53	
Transport--CO2 from coal						
Transport--CO2 from oil	1,419.55	1,541.47	1,830.00	28.91	1,680.00	18.35
Transport--CO2 from oil/road use	1,141.46	1,269.17	1,500.00	31.41	1,350.00	18.27
Transport--CO2 from non-road oil	278.09	272.30	330.00	18.67	330.00	18.67
Transport--CO2 from gas	36.01	38.30	40.00	11.08	40.00	11.08
Transport--total CO2	1,455.57	1,579.77	1,870.00	28.47	1,720.00	18.17
Transport--coal %	0.00	0.00	0.00		0.00	
Transport--oil %	28.93	29.48	29.55		29.64	
Transport--oil road use %	23.26	24.27	24.22		23.82	
Transport--road use % transport oil	80.41	82.34	81.97		80.36	
Transport--road use % of total oil	54.38	58.09	60.24		58.95	
Transport--non-road oil use %	5.67	5.21	5.33		5.82	
Transport--gas %	0.73	0.73	0.65		0.71	
Transport--all fuels %	29.66	30.21	30.20		30.35	
Other--CO2 from coal	34.30	6.35	6.00	-82.51	6.00	-82.51
Other--CO2 from oil	188.95	187.33	230.00	21.73	210.00	11.14
Other--CO2 from gas	382.83	429.33	500.00	30.61	490.00	27.99
Other--total CO2	606.08	623.02	736.00	21.44	706.00	16.49
Other--coal %	0.70	0.12	0.10		0.11	
Other--oil %	3.85	3.58	3.71		3.71	
Other--gas %	7.80	8.21	8.07		8.65	
Other--all fuels %	12.35	11.92	11.89		12.46	
Total energy CO2 from coal	1,781.73	1,855.04	2,287.50	28.39	1,827.50	2.57
Total energy CO2 from oil	2,099.06	2,184.69	2,490.00	18.62	2,290.00	9.10
Total energy CO2 from gas	1,026.72	1,188.79	1,415.00	37.82	1,550.00	50.97
Total energy CO2--all fuels	4,907.51	5,228.52	6,192.50	26.18	5,667.50	15.49
Total energy CO2--coal %	36.31	35.48	36.94		32.25	
Total energy CO2--oil %	42.77	41.78	40.21		40.41	
Total energy CO2--gas %	20.92	22.74	22.85		27.35	
Marine bunkers--CO2 from oil	91.05	85.98				
Marine bunkers--oil %	1.86	1.64				

Non-energy CO2--fuel leaks	6.56	6.20	6.50		6.00	
Non-energy CO2--industry	54.90	63.88	66.00	20.22	65.00	18.40
Non-energy CO2--waste						
Non-energy CO2--other						
Non-energy CO2--total	61.46	70.08	72.50	17.96	71.00	15.52
Non-energy CO2--% total	1.24	1.32	1.16		1.24	
Total CO2	4,968.97	5,298.60	6,265.00	26.08	5,738.50	15.49
CH4—fuels	956.00	801.00	700.00	-26.78	650.00	-32.01
CH4—leaks	9,893.00	9,347.00	8,800.00	-11.05	8,500.00	-14.08
CH4--livestock	8,310.00	9,079.00	9,300.00	11.91	9,100.00	9.51
CH4--other agriculture	448.00	489.00	500.00		450.00	
CH4--waste	9,971.00	11,259.00	8,500.00	-14.75	8,000.00	-19.77
CH4--other						
CH4--total	29,578.00	30,975.00	27,800.00	-6.01	26,700.00	-9.73
CH4--total CO2 equivalent	621.14	650.48	583.80	-6.01	560.70	-9.73
CH4—fuels %	3.23	2.59	2.52		2.43	
CH4—leaks %	33.45	30.18	31.65		31.84	
CH4--livestock %	28.10	29.31	33.45		34.08	
CH4--other agriculture %	1.51	1.58	1.80		1.69	
CH4--waste %	33.71	36.35	30.58		29.96	
CH4--other %	0.00	0.00	0.00		0.00	
N2O--transport	98.00	109.00	115.00	17.35	100.00	2.04
N2O--other energy	35.00	36.00	40.00		36.00	
N2O--industry	96.00	105.00	110.00	14.58	105.00	9.38
N2O--agriculture	196.00	217.00	230.00	17.35	210.00	7.14
N2O--waste						
N2O--other						
N2O--total	425.00	467.00	495.00	16.47	451.00	6.12
N2O--total CO2 equivalent	131.75	144.77	153.45	16.47	139.81	6.12
N2O--transport %	23.06	23.34	23.23		22.17	
N2O--other energy %	8.24	7.71	8.08		7.98	
N2O--industry %	22.59	22.48	22.22		23.28	
N2O--agriculture %	46.12	46.47	46.46		46.56	
N2O--waste %	0.00	0.00	0.00		0.00	
N2O--other %	0.00	0.00	0.00		0.00	
HFC-134a						
HFC-23a						
HFC-152a						
HFCs--total CO2 equivalent	44.04	76.65	150.00	240.60	150.00	240.60
CF4						
C2F6						
PFCs--total CO2 equivalent	18.35	29.19	20.00	8.99	14.00	-23.71
SF6						

SF6--total CO2 equivalent	25.69	30.83	35.00	36.24	33.00	28.45
CO2 energy--RAI calculation	4,907.51	5,228.52	6,192.50	26.18	5,667.50	15.49
CO2 total--RAI calculation	4,968.97	5,298.60	6,265.00	26.08	5,738.50	15.49
CH4 total--RAI calculation	621.14	650.48	583.80	-6.01	560.70	-9.73
N2O total--RAI calculation	131.75	144.77	153.45	16.47	139.81	6.12
HFC total--RAI calculation	44.04	76.65	150.00	95.69	150.00	95.69
PFC total--RAI calculation	18.35	29.19	20.00	-31.47	14.00	-52.03
SF6 total--RAI calculation	25.69	30.83	35.00	13.52	33.00	7.04
GHG total--RAI calculation	5,809.94	6,230.52	7,207.25	23.02	6,636.01	13.27
CO2 energy %	84.47	83.92	85.92		85.41	
CO2 total %	85.53	85.04	86.93		86.48	
CH4 total %	10.69	10.44	8.10		8.45	
N2O total %	2.27	2.32	2.13		2.11	
HFC total %	0.76	1.23	2.08		2.26	
PFC total %	0.32	0.47	0.28		0.21	
SF6 total %	0.44	0.49	0.49		0.50	
CO2 energy	4,907.51	5,228.52				
CO2 total--gov. forecast	4,968.97	5,298.60	6,118.55			
CH4 total--gov. forecast	621.14	650.48	557.21			
N2O total--gov. forecast	131.75	144.77	124.62			
HFC total--gov. forecast	44.04	76.65	150.00			
PFC total--gov. forecast	18.35	29.19				
SF6 total--gov. forecast	25.69	30.83				
GHG total--gov. forecast	5,809.94	6,230.52	6,950.39			

Sources: IEA for 1990-95 energy CO2, FCCC secretariat for other 1990-95 data, RAI for all other.

TABLE 6: EMISSIONS OUTLOOK FOR RUSSIA
(MILLION TONNES CO2 EQUIVALENT)

	1990 IEA	1995 IEA	2010 HIGH	HIGH %90/95	2010 LOW	LOW %90/95
Land area (square km)	16,995,800	16,995,800	16,995,800		16,995,800	
Population (thousands)	147,913	148,200	143,134	-3.23	143,134	-3.23
Population density	8.70	8.72	8.42		8.42	
GDP (billion USD, PPP basis)	1,108.82	689.95				
GDP per capita (PPP basis)	7,496	4,656				
TPES including combust. renew.		628.17				
Renewable %		3.77				
TPES, million TOE		604.46				
TPES per capita (TOE per person)	0.00	4.08				
TPES per GDP (TOE per M USD)	0.0	876.1				
Energy CO2 per capita	15.53	10.44				
Energy CO2 per GDP	2,071.57	2,243.48				
Energy CO2 per TPES		2.56				
Utilities--CO2 from coal	350.00	196.46	250.00	-28.57	210.00	-40.00
Utilities--CO2 from oil	240.00	142.03	180.00	-25.00	150.00	-37.50
Utilities--CO2 from gas	450.00	399.78	500.00	11.11	450.00	0.00
Utilities--total CO2	1,040.00	738.27	930.00	-10.58	810.00	-22.12
Utilities--coal % of utility CO2	33.65	26.61	26.88		25.93	
Utilities--oil % of utility CO2	23.08	19.24	19.35		18.52	
Utilities--gas % of utility CO2	43.27	54.15	53.76		55.56	
Utilities--coal % of total CO2	15.24	12.69	10.76		12.25	
Utilities--oil % of total CO2	10.45	9.18	7.74		8.75	
Utilities--gas % of total CO2	19.59	25.83	21.51		26.24	
Utilities--all fuels % of total CO2	45.28	47.70	40.01		47.23	
Auto-producers--CO2 from coal		37.05	47.00		40.00	
Auto-producers--CO2 from oil						
Auto-producers--CO2 from gas		13.34	18.00		14.00	
Auto-producers--total CO2		50.39	65.00		54.00	
Auto-producers--coal %	0.00	2.39	2.02		2.33	
Auto-producers--oil %	0.00	0.00	0.00		0.00	
Auto-producers--gas %	0.00	0.86	0.77		0.82	
Auto-producers--all fuels %	0.00	3.26	2.80		3.15	
Energy industry--CO2 from coal	7.00	1.42	1.80	-74.29	1.40	-80.00
Energy industry--CO2 from oil	45.00	16.36	35.00	-22.22	18.00	-60.00
Energy industry--CO2 from gas	9.00	3.07	11.00	22.22	5.00	-44.44
Energy industry--total CO2	61.00	20.85	47.80	-21.64	24.40	-60.00
Energy industry--coal %	0.30	0.09	0.08		0.08	
Energy industry--oil %	1.96	1.06	1.51		1.05	

Energy industry--gas %	0.39	0.20	0.47		0.29	
Energy industry--all fuels %	2.66	1.35	2.06		1.42	
All energy industries--total CO2	1,101.00	809.51	1,042.80	-5.29	888.40	-19.31
All energy industries--all fuels %	47.93	52.30	44.87		51.80	
Manuf. & construc.--CO2 from coal	120.00	123.62	140.00	16.67	130.00	8.33
Manuf. & construc.--CO2 from oil	90.00	53.33	90.00	0.00	60.00	-33.33
Manuf. & construc.--CO2 from gas	200.00	85.53	220.00	10.00	100.00	-50.00
Manuf. & construc.--total CO2	410.00	262.47	450.00	9.76	290.00	-29.27
Manuf. & construc.--coal %	5.22	7.99	6.02		7.58	
Manuf. & construc.--oil %	3.92	3.45	3.87		3.50	
Manuf. & construc.--gas %	8.71	5.53	9.47		5.83	
Manuf. & construc.--all fuels %	17.85	16.96	19.36		16.91	
Transport--CO2 from coal	1.00	1.47	1.50	50.00	1.50	50.00
Transport--CO2 from oil	275.00	77.38	280.00	1.82	120.00	-56.36
Transport--CO2 from oil/road use	65.00	27.33	80.00	23.08	40.00	-38.46
Transport--CO2 from non-road oil	210.00	50.05	200.00	-4.76	80.00	-61.90
Transport--CO2 from gas	40.00	29.30	50.00	25.00	35.00	-12.50
Transport--total CO2	316.00	108.15	331.50	4.91	156.50	-50.47
Transport--coal %	0.04	0.10	0.06		0.09	
Transport--oil %	11.97	5.00	12.05		7.00	
Transport--oil road use %	2.83	1.77	3.44		2.33	
Transport--road use % transport oil	23.64	35.32				
Transport--road use % of total oil	8.55	6.59	11.19		8.55	
Transport--non-road oil use %	9.14	3.23	8.60		4.67	
Transport--gas %	1.74	1.89	2.15		2.04	
Transport--all fuels %	13.76	6.99	14.26		9.13	
Other--CO2 from coal	160.00	66.44	120.00	-25.00	80.00	-50.00
Other--CO2 from oil	110.00	101.20	130.00	18.18	120.00	9.09
Other--CO2 from gas	200.00	156.47	250.00	25.00	180.00	-10.00
Other--total CO2	470.00	324.11	500.00	6.38	380.00	-19.15
Other--coal %	6.97	4.29	5.16		4.67	
Other--oil %	4.79	6.54	5.59		7.00	
Other--gas %	8.71	10.11	10.76		10.50	
Other--all fuels %	20.46	20.94	21.51		22.16	
Total energy CO2 from coal	638.00	426.63	560.30	-12.18	462.90	-27.45
Total energy CO2 from oil	760.00	414.81	715.00	-5.92	468.00	-38.42
Total energy CO2 from gas	899.00	706.45	1,049.00	16.69	784.00	-12.79
Total energy CO2--all fuels	2,297.00	1,547.89	2,324.30	1.19	1,714.90	-25.34
Total energy CO2--coal %	27.78	27.56	24.11		26.99	
Total energy CO2--oil %	33.09	26.80	30.76		27.29	
Total energy CO2--gas %	39.14	45.64	45.13		45.72	
Marine bunkers--CO2 from oil						
Marine bunkers--oil %	0.00	0.00				

Non-energy CO2--fuel leaks	27.10	17.90	20.00		17.00	
Non-energy CO2--industry	46.30	24.00	35.00	-24.41	24.00	-48.16
Non-energy CO2--waste						
Non-energy CO2--other						
Non-energy CO2--total	73.40	41.90	55.00	-25.07	41.00	-44.14
Non-energy CO2--% total	3.10	2.64	2.31		2.34	
Total CO2	2,370.40	1,589.79	2,379.30		1,755.90	
CH4—fuels	200.00	130.00	150.00	-25.00	130.00	-35.00
CH4—leaks	18,900.00	13,300.00	13,000.00	-31.22	11,000.00	-41.80
CH4--livestock	4,930.00	3,700.00	4,000.00	-18.86	3,700.00	-24.95
CH4--other agriculture	130.00	130.00	130.00	0.00	130.00	0.00
CH4--waste	1,940.00	1,950.00	1,950.00	0.52	1,930.00	-0.52
CH4--other	400.00	400.00	400.00	0.00	400.00	0.00
CH4--total	26,500.00	19,610.00	19,630.00	-25.92	17,290.00	-34.75
CH4--total CO2 equivalent	556.50	411.81	412.23	-25.92	363.09	-34.75
CH4—fuels %	0.75	0.66	0.76		0.75	
CH4—leaks %	71.32	67.82	66.23		63.62	
CH4--livestock %	18.60	18.87	20.38		21.40	
CH4--other agriculture %	0.49	0.66	0.66		0.75	
CH4--waste %	7.32	9.94	9.93		11.16	
CH4--other %	1.51	2.04	2.04		2.31	
N2O--transport			8.50		8.00	
N2O--other energy	17.40	11.10	13.00	-25.29	11.00	-36.78
N2O--industry	3.00	1.20	3.00	0.00	1.20	-60.00
N2O--agriculture	200.00	110.00	150.00	-25.00	110.00	-45.00
N2O--waste	0.30	0.30	0.30	0.00	0.30	0.00
N2O--other	5.00	5.00	5.00	0.00	5.00	0.00
N2O--total	225.70	127.60	179.80	-20.34	135.50	-39.96
N2O--total CO2 equivalent	69.97	39.56	55.74	-20.34	42.01	-39.96
N2O--transport %	0.00	0.00	4.73		5.90	
N2O--other energy %	7.71	8.70	7.23		8.12	
N2O--industry %	1.33	0.94	1.67		0.89	
N2O--agriculture %	88.61	86.21	83.43		81.18	
N2O--waste %	0.13	0.24	0.17		0.22	
N2O--other %	2.22	3.92	2.78		3.69	
HFC-134a						
HFC-23a						
HFC-152a						
HFCs--total CO2 equivalent	9.66	9.66				
CF4						
C2F6						
PFCs--total CO2 equivalent	31.91	28.94				
SF6						

SF6--total CO2 equivalent						
CO2 energy--RAI calculation	2,297.00	1,547.89	2,324.30	1.19	1,714.90	-25.34
CO2 total--RAI calculation	2,370.40	1,589.79	2,379.30	0.38	1,755.90	-25.92
CH4 total--RAI calculation	556.50	411.81	412.23	-25.92	363.09	-34.75
N2O total--RAI calculation	69.97	39.56	55.74	-20.34	42.01	-39.96
HFC total--RAI calculation	9.66	9.66				
PFC total--RAI calculation	31.91	28.94				
SF6 total--RAI calculation	0.00	0.00				
GHG total--RAI calculation	3,038.43	2,079.75	2,847.27	-6.20	2,161.00	-28.81
CO2 energy %	75.60	74.43	81.63		79.36	
CO2 total %	78.01	76.44	83.56		81.25	
CH4 total %	18.32	19.80	14.48		16.80	
N2O total %	2.30	1.90	1.96		1.94	
HFC total %	0.32	0.46	0.00		0.00	
PFC total %	1.05	1.39	0.00		0.00	
SF6 total %	0.00	0.00	0.00		0.00	
CO2 energy	2,297.00	1,547.89				
CO2 total--gov. forecast	2,370.40	1,589.79	2,300.00			
CH4 total--gov. forecast	556.50	411.81	504.00			
N2O total--gov. forecast	69.97	39.56	55.80			
HFC total--gov. forecast	9.66	9.66	0.00			
PFC total--gov. forecast	31.91	28.94	0.00			
SF6 total--gov. forecast	0.00	0.00	0.00			
GHG total--gov. forecast	3,038.43	2,079.75	2,859.80			

Sources: IEA for 1995 energy CO2, FCCC secretariat for other 1990, 1995 data, RAI for all other.

TABLE 7: ACTIVITIES IMPLEMENTED JOINTLY, ANALYSIS BY PROJECT TYPE (TONNES CO2)

SECTOR	NUMBER PROJ.	TOTAL TONNES	AVER. LIFE	ANNUAL TONNES	PROJECT ANNUAL	% NUMBER	% ANNUAL
Agriculture	2	50,687	12	3,394	1,697	2.15	0.05
Energy - total	77	73,931,033	14	3,453,406	44,849	82.80	49.23
efficiency total	35	7,723,689	12	916,986	26,200	37.63	13.07
effic. - dist. heat	14	1,734,000	12	68,243	4,874	15.05	0.97
renewable total	40	33,183,262	14	1,171,838	29,296	43.01	16.71
renewable biomass	29	7,127,280	12	441,636	15,229	31.18	6.30
renewable solar	2	34,411	12	1,446	723	2.15	0.02
renewable wind	4	328,514	16	18,065	4,516	4.30	0.26
Forests - total	13	87,680,632	32	3,556,688	273,591	13.98	50.71
afforestation	1	292,728	40	7,318	7,318	1.08	0.10
reforestation	5	9,572,482	36	246,573	49,315	5.38	3.52
preservation	6	74,750,089	28	3,200,620	533,437	6.45	45.63
Waste	1	7,300	10	730	730	1.08	0.01
TOTALS	93	161,669,652	16	7,014,218	75,422	100.00	100.00
ex. forest preserv.	87	86,919,563	16	3,813,599	43,834	93.55	54.37
ex. all forests	80	73,989,020	14	3,457,530	43,219	86.02	49.29

Source: Climate change secretariat document FCCC/CP/1998/2, 5 October 1998

Endnotes

1. The author is an international consultant who was previously chief economist, regulatory programs, US Department of Energy (1978-81); coordinator of US trade policy for energy, chemicals and natural resources, Office of US Trade Representative (1982-90); Deputy Assistant Secretary for environment, health and natural resources, US Department of State (1990-93), chief US negotiator, UN Framework Convention on Climate Change (1991-92); and chairman, working group on response strategies and working group on impacts, adaptation and mitigation, UN Intergovernmental Panel on Climate Change (1991-93).

2. This paper was originally presented to the Electric Utilities and Environment Conference in Tucson, AZ, on 11 January 1999. The estimates of national GHG emissions have subsequently been updated and the tables here reflect those revisions.

3. Kyoto Protocol to the United Nations Framework Convention on Climate Change, adopted 11 December 1997 and opened for signature 16 March 1998, original text contained in document FCCC/CP/1997/L.7/Add.1 of the Third Session of the Conference of the Parties, 10 December 1997 [hereinafter Kyoto Protocol].

4. United Nations Framework Convention on Climate Change, adopted 9 May 1992 and opened for signature 4 June 1992, Annex I of *Report of the Intergovernmental Negotiating Committee for a Framework Convention on Climate Change on the Work of the Second Part of Its Fifth Session, Held at New York From 30 April to 9 May 1992.* UN Doc. A/AC.237/18 (Part II), and reprinted at 31 I.L.M. 849 (1992) [hereinafter FCCC].

5. Specific targets listed in Annex B are: 92% of base period emission levels (all 15 EU Member States, Bulgaria, Czech Republic, Estonia, Latvia, Liechtenstein, Lithuania, Romania, Slovakia, Slovenia, Switzerland), 93% (United States), 94% (Canada, Hungary, Japan, Poland), 95% (Croatia), 100% (New Zealand, Russia, Ukraine); 101% (Norway) 108% of 1990 (Australia), 110% (Iceland). Base period is 1990 except for Bulgaria (1988), Hungary (average of 1985-87) and Poland (1988), which may have the flexibility to use an earlier base period in accordance with FCCC Article 4.6 and Kyoto Protocol Articles 3.5 and 3.6; countries may also choose 1995 rather than 1990 as the base year for HFCs PFCs and SF6, in accordance with Kyoto Protocol Article 3.8.

6. The US government's official projection for climate change purposes, shown at the end of Table 5, is included in UNFCCC Secretariat Document FCCC/CP/1998/11/Add.2, "Tables of Inventories of Anthropogenic Emissions and Removals for 1990-1995 and Projections up to 2020," 7 October 1998. Other estimates done by the US Energy Information Administration indicate US CO_2 emissions increasing by more than 30% above 1990 levels by 2010.

7. The target percentages listed in Annex B to the Kyoto Protocol (or in the Council Conclusions of the June 1998 meeting of the EU Council of Ministers) are multiplied by the 1990 base level for CO_2, CH_4 and N_2O plus the 1995 assumed base level for HFCs, PFCs and SF_6 to obtain the targets in terms of tonnes of CO_2 equivalent for 2010. The actual "assigned amounts" for the 2008-2012

commitment period would be five times this figure, and could not be exceeded for the five-year period in total. For Hungary, the base year figure is for the average of 1985-87. For Poland, the base is 1988, but the CO_2 emission estimates provided to the FCCC secretariat are considerably higher than those estimated by the IEA. In order to make the estimates comparable for purposes of comparing the projections for 2010 with a Kyoto target based on a 1988 reference year, the CO_2 estimate of 477.473 million tonnes for 1988 was adjusted by multiplying the IEA 1990 estimate by the ratio of the Polish government estimates for 1988 and 1990, i.e., 364.12 million tonnes times 477.473/414.93 (the last figure is taken from FCCC/CP/1996/12, Table 1). The resulting adjusted CO_2 number for 1988 would then be 419 million tonnes and the total emission of all GHGs 501.18 million tonnes of CO_2 equivalent.

8. The Russian government's official projection for climate change purposes, shown at the end of Table 6, is included in UNFCCC Secretariat Document FCCC/CP/1998/11/Add.2, "Tables of Inventories of Anthropogenic Emissions and Removals for 1990-1995 and Projections up to 2020," 7 October 1998. Other estimates can be found in Russian Federal Service for Hydrometeorology and Environmental Monitoring (Hydromet), "Russian Federation Climate Change Country Study," Volume 1 (Inventory of technogenic GHG emissions), Volume 2 (Inventory of GHG sinks and emissions related to terrestrial ecosystems), and Volume 5 (Synthesis activity), Moscow, 1997. In this last source, two scenarios are provided (p. 81) for CO_2 emissions from fuel combustion in 2010; under the "optimistic scenario" emissions would be 2,108 million tonnes (575 MtC) while under the "probable scenario they would be 1,947 million tonnes (531 MtC). These are clearly comparable to the high estimate of 2,193 million tonnes and the low estimate of 1,697 million tonnes shown in Table 6, although the "probable" scenario looks less probable today.

9. Briefing by Alexei Kokorin, head of Russian delegation to UNFCCC meetings, on 9 June 1998 in Bonn. Three phases for Russian use of flexibility were indicated: (1) Creation of transferable credits through Article 6 joint implementation of projects involving outside funding and technology; (2) Creation of credits through self-initiated projects using technology and experience gained under phase 1; and (3) trading of emission allowances under Article 17. Similar indications of the Russian approach to flexibility mechanisms have been given in various private meetings with high-level officials of other governments.

10. Russian trading in crude oil and natural gas has a long history, although most of it in the past has involved longer-term contracts or direct government-to-government deals. Russian inexperience in international aluminum and uranium trading led to mistakes and major trade disputes in the early 1990s.

11. UNFCCC Secretariat Document FCCC/CP/1998/2, "Activities Implemented Jointly: Review of Progress Under the Pilot Phase (Decision 5/CP.1), Second synthesis report on activities implemented jointly," 5 October 1998.

12. Experts at the US Joint Implementation office estimate that the maximum number of projects that could be evaluated by the US each year, with greatly expanded staffing and budget support, would be at most 300. Over the past four or five years the group has evaluated about 100 JI

projects, of which 32 have actually met all criteria and been selected. This implies that the US administrative system is capable in the future of approving at most about 100 projects per year.

13. The eight countries ratifying the Kyoto Protocol, as of 9 April 1999, are: Antigua and Barbuda, Bahamas, El Salvador, Fiji, Maldives, Panama, Trinidad and Tobago and Tuvalu.

14. Senate Resolution 98, the so-called Byrd-Hagel Resolution, was passed by a vote of 95-0 on 25 July 1997 and called on US negotiators involved in the Kyoto Protocol not to agree to any treaty that would "mandate new commitments to limit or reduce greenhouse gas emissions for the Annex I Parties, unless the protocol or other agreement also mandates new specific scheduled commitments to limit or reduce greenhouse gas emissions for Developing Country Parties within the same compliance period," or that would "result in serious harm to the economy of the United States."

ASSOCIATED BUILDERS AND CONTRACTORS, INC.

April 28, 1999

The Honorable James Talent
Chairman, Small Business Committee
United States House of Representatives
Washington DC 20515

Dear Chairman Talent:

On behalf of Associated Builders and Contractors (ABC) and its more than 20,000 contractors, subcontractors, material suppliers, and related firms across the country I would like to express our concern with the Administration's efforts to proceed with the Kyoto Protocol and the effect it will have on small businesses in the construction industry and respectfully submit the following comments for the record.

The Kyoto Protocol will require nations to make compulsory (enforceable) reductions in greenhouse gas emissions, particularly Carbon Dioxide. It specifically states that while the U.S. must reduce it greenhouse gas emissions to 1990 levels developing nations such as India and Brazil would not face the same constraints. Currently, there is no technology that will change Carbon Dioxide into something else. Thus, the only way to achieve significant reductions in these emissions is to burn less fossil fuels including oil, gas, and coal.

ABC is very concerned with the greenhouse emissions controls negotiated and signed by the Administration in Buenos Aires. Our members believe this agreement will have an immediate impact on the building and contracting industry through higher energy prices, stricter zoning requirements and higher fuel economy standards. They believe the agreement, if ratified, will restrict availability and lead to higher costs for the vans, light trucks, and other equipment our members depend upon.

ABC members depend on a strong economy to foster growth of businesses that in turn sustain construction. If emissions reductions were required only by industrialized nations, the US would be placed at a considerable trade and economic disadvantage. U.S. manufacturing costs would be higher while those of developing countries would be lower. Thus, forcing companies to move overseas, taking the jobs with them.

The truth of the matter is scientists do not agree on whether or not global warming is really even occurring, much less how fast it is occurring, or what effects it would have. Since there is insufficient evidence to answer basic questions about global climate change and what causes it, the U.S. should not rush into any international treaty that forces

1300 North Seventeenth Street ▪ Rosslyn, Virginia 22209 ▪ (703) 812-2000

unwelcome and expensive changes in our lives and livelihoods. The construction industry is already over burdened with federal, state, and local regulations and paperwork requirements, and oppose such additional restrictions until there is sufficient established research and evidence about global warming to justify the cost and benefits of such efforts.

Sincerely,

Shane Downey
Washington Representative

JAMES M. TALENT, MISSOURI
CHAIRMAN

NYDIA M. VELÁZQUEZ, NEW YORK

Congress of the United States
House of Representatives
106th Congress
Committee on Small Business
2361 Rayburn House Office Building
Washington, DC 20515-0515

March 10, 1999

By Facsimile

His Excellency Naresh Chandra
Ambassador of India
Attn: Ms. Shamma Jain
2107 Massachusetts Avenue, N.W.
Washington, D.C. 20008

Re: The Kyoto Protocol to the United Nations Framework Convention on Climate Change

His Excellency:

The Kyoto Protocol to the United Nations Framework Convention on Climate Change (the Protocol) commits signatory nations to limit emissions of six "greenhouse gases." In November, 1998, United States Ambassador to the United Nations, Peter Burleigh, signed the Protocol on the United States' behalf. To date, India is not a Protocol signatory.

It is my understanding that India recognizes the importance in maintaining a safe and healthy environment but declines to accept the Protocol's greenhouse limitations. In order to further understand India's position, could you please respond to the following questions at your earliest opportunity.

1. Please explain whether India is currently negotiating global warming policies with the United States or any other country.
2. Please explain whether the India supports, as written, the Protocol.
3. Please explain when and under what circumstances India would be willing to pledge to reduce carbon dioxide emissions.
4. Is India open to negotiate any pledge to reduce carbon dioxide emissions?

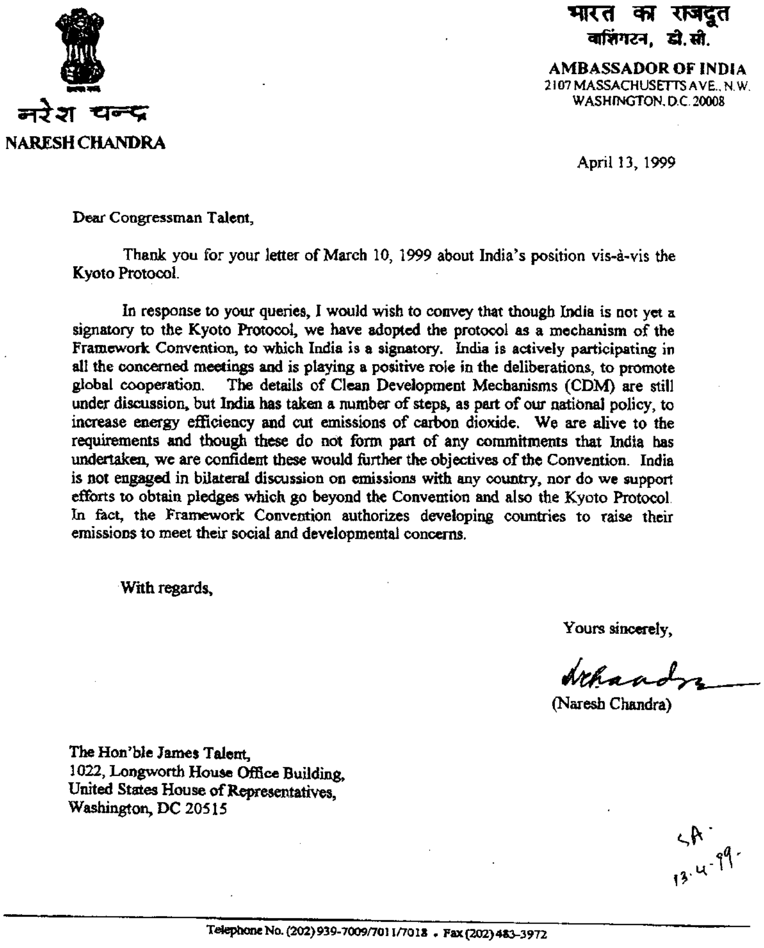
5. Have officials in India made any formal policy statements to explain its global warming policy position? If so, may I obtain copies, in English, of these statements.

Thank you for your cooperation in this matter. If you have any questions, please contact Paul Denham ((202) 225-5821) of the Committee Staff.

Sincerely,

Jim Talent

James M. Talent
Chairman



नरेश चन्द्र
NARESH CHANDRA

भारत का राजदूत
वाशिंगटन, डी.सी.
AMBASSADOR OF INDIA
2107 MASSACHUSETTS AVE., N.W.
WASHINGTON, D.C. 20008

April 13, 1999

Dear Congressman Talent,

Thank you for your letter of March 10, 1999 about India's position vis-à-vis the Kyoto Protocol.

In response to your queries, I would wish to convey that though India is not yet a signatory to the Kyoto Protocol, we have adopted the protocol as a mechanism of the Framework Convention, to which India is a signatory. India is actively participating in all the concerned meetings and is playing a positive role in the deliberations, to promote global cooperation. The details of Clean Development Mechanisms (CDM) are still under discussion, but India has taken a number of steps, as part of our national policy, to increase energy efficiency and cut emissions of carbon dioxide. We are alive to the requirements and though these do not form part of any commitments that India has undertaken, we are confident these would further the objectives of the Convention. India is not engaged in bilateral discussion on emissions with any country, nor do we support efforts to obtain pledges which go beyond the Convention and also the Kyoto Protocol. In fact, the Framework Convention authorizes developing countries to raise their emissions to meet their social and developmental concerns.

With regards,

Yours sincerely,

(Naresh Chandra)

The Hon'ble James Talent,
1022, Longworth House Office Building,
United States House of Representatives,
Washington, DC 20515

SA.
13.4.99.

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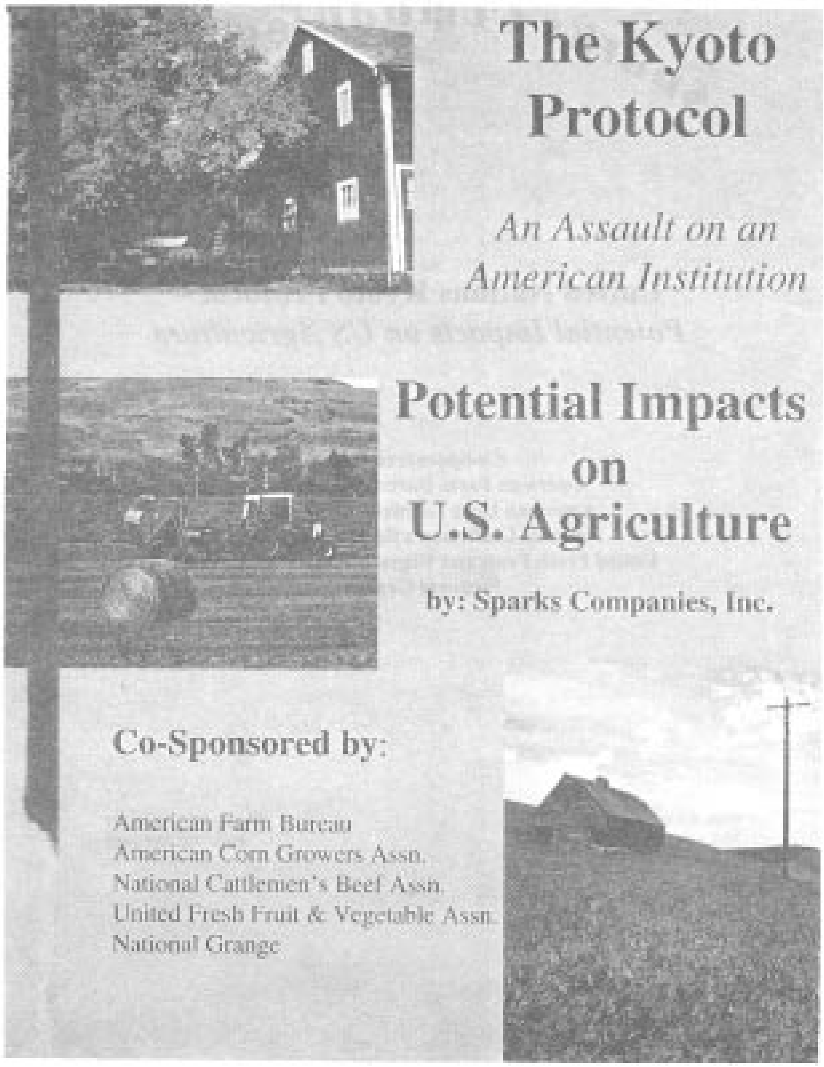

The Kyoto Protocol

An Assault on an American Institution

Potential Impacts on U.S. Agriculture

by: Sparks Companies, Inc.

Co-Sponsored by:

American Farm Bureau
American Corn Growers Assn.
National Cattlemen's Beef Assn.
United Fresh Fruit & Vegetable Assn.
National Grange

Sparks Companies, Inc.

United Nations Kyoto Protocol – *Potential Impacts on US Agriculture*

Co-Sponsored By:
American Farm Bureau Federation,
American Corn Growers Association,
National Cattlemen's Beef Association,
United Fresh Fruit and Vegetable Association, and
National Grange

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United Nations Kyoto Protocol –
Potential Impacts on US Agriculture

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United Nations Kyoto Protocol – *Potential Impacts on US Agriculture*

I. Introduction

American agriculture is the envy of the world. The American farmer feeds not only citizens of the United States but millions of others worldwide – in both developing and developed countries – increasing the prospect for healthy and productive lives.

Traditionally, farmers have coped with drought and disease, falling prices and shrinking profits. Now, the family farm faces a new threat that may bring unexpected hardship to many in the near future.

In December 1997, over 180 nations met in Kyoto, Japan, to finalize negotiations on a legally binding international treaty aimed at lowering greenhouse gas emissions. The new treaty – called the UN Kyoto Protocol – requires a handful of nations, including the United States, to reduce their greenhouse gas emissions to specific levels by the years 2008-2012, the first budget period. While each country accepted a different level of emission reductions, on average the agreement seeks to reduce emissions to 5% below 1990 levels during the first budget period. For its part, the United States agreed to reduce its emissions to 7% below 1990 levels by this timeframe. Additional emission reductions will be required in the second budget period (2013-2018), however, the level of reductions required in that timeframe will be the subject of future international negotiations. Key aspects of the Protocol include:

- The agreement covers six gases (CO_2, methane, nitrous oxide, HFCs, PFCs, and SF_6).
- The concept of greenhouse gas emissions trading will be allowed, but the rules, guidelines and structure of an international system have yet to be determined.
- Countries with emerging economies such as China, India, Mexico and South Korea, exempted themselves from the Protocol, as a proposal to allow these developing countries to adopt voluntary emission reductions failed.
- The definition of sinks (objects that 'clean, or remove emissions, from the atmosphere') was limited to include only forestry activities. Agricultural crops and other vegetation are not considered sinks by the Kyoto Protocol.
- Enforcement measures of the Protocol by the United Nations were left undefined and will be the subject of future international negotiations.

Analysis by the US Energy Information Administration (EIA) shows that demand for energy will continue to grow well into the next century. Because of this increase in energy usage, EIA predicts that greenhouse gas emissions will be at least 25-30% higher in 2010 than in 1990.[1] This means the United States will have to reduce its energy consumption by at least 37% in order to meet its commitments under the Kyoto Protocol. These energy restrictions may result in higher energy costs for farmers, small businesses and other working families.

Of the six greenhouse gases, agriculture is the primary emitter of two – methane and nitrous oxide – and a significant emitter of a third – carbon dioxide. Methane emissions come from livestock operations and rice farming, while any fertilizer use causes nitrous oxide emissions. Several international organizations have recommended ways to reduce emissions of these two gases (e.g., reduce livestock herds, tax fertilizer usage, and restrict how, when and where fertilizers are applied). However, this study only looks at how agriculture will be affected by Kyoto-related requirements to reduce carbon dioxide.

The remainder of this section provides general introductory information on the various means of controlling greenhouse gas emissions and the likely incidence of their relative effects on various sectors of the economy. Section II then examines the expected macroeconomic effects, reported in other studies, of the most likely scenario resulting from the Kyoto Protocol for the US economy. In Section III, these results are utilized in evaluating the resultant impacts on the relatively energy intensive farm sector. Section IV contains the results of further examining the string of effects, to the microeconomic level – to typical farms that might be found in the agriculture sector. Section V contains the evaluation from further extrapolating the agriculture sector impacts forward toward the ultimate food consumer. The final section contains summary observations and conclusions about the likely economic impacts resulting from adoption of a global carbon emissions policy.

Several studies have been made of expected impacts of federal constraints on carbon emissions and on the US economy. Conclusions by DRI/McGraw-Hill are used in this study, and are presented briefly below.

Carbon levels in the atmosphere from greenhouse gas emissions can be controlled in several ways, including carbon taxes or by federal requirements for permits for emitters. Permits could be simply issued at no cost or auctioned by the federal government, with the total sold providing the final control on emission levels. Emissions also could be controlled by a federal emissions tax, with each ton of emissions taxed at the marginal cost abatement, and by other regulatory schemes of increasing complexity. The DRI study assumes that permits would be used, and that they could be traded in the open market. In each case, it is assumed that annual permits for 1,243 million tons of carbon emissions (the target 93% of 1990 levels) would be issued to industry at no cost based upon businesses' 1990 level of emissions. With a permit system, the permits would be tradable, and the trading price would equal the marginal cost of abatement. The permit system is assumed to be gradually phased in during 2000-10.

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[1] Published in EIA's 'Annual Energy Outlook 1998.'

The impacts upon the economy of achieving this target would be quite considerable. In its base case projections (i.e., assuming no Kyoto Protocol and a continuation of the current situation), DRI forecast that US emissions would grow from 1,466 million tons in 1997 to 1,740 million tons by 2010 and 1,886 million tons by 2020. This would require a net annual reduction in emissions of just over 500 million tons by 2010 to achieve the required objective. DRI analyzed three possible scenarios, using varying degrees of each available method, to reach Kyoto emissions limits (Table 1).

Table 1. Sources of US Carbon Reductions
DRI Cases and Assumptions

	Case 1	*Case 2*	*Case 3*
	% of required reduction		
Sinks and Offsets From Other Gases	8	12	16
Purchases From Abroad	15	30	55
Changes/Reductions in Domestic Energy Use	77	58	29

For the purposes of this study, Case 1 is used, primarily because it assumes that the bulk of carbon emission reductions will come from changes in domestic use.

The estimated carbon emissions permit price required to reduce carbon emissions in 2010 to the target level is estimated to be $177 per ton (in constant 1997 dollars), growing to $193 per ton by 2020, taxes that would increase energy costs to consumers substantially (Table 2). Coal, with the highest carbon content of the fuels (and the lowest price per Btu), experiences the largest percentage increase. By contrast, gasoline, with its medium carbon content and high tax and non-fuel cost components, experiences the smallest increases in price. Real (inflation adjusted) producer energy prices increase an average of nearly 64% between 2008 and 2020, while consumer prices rise nearly 42% on average.

Table 2. Real Energy Price Increases, 2008-2020

	Year-By-Year Increases from Baseline (%)						***Average***
	2008	***2009***	***2010***	***2011***	***2012***	***2020***	***Change***
Gasoline - Retail	26.2	27.5	29.5	30.1	30.7	27.5	28.6
Residential Fuel	79.8	83.2	86.1	89.9	90.4	74.4	83.7
Electric Utility Coal	355.9	382.9	406.0	433.6	449.6	466.4	415.0
Electric Utility Natural Gas	103.8	107.9	110.9	115.1	115.2	90.9	106.8
Electricity – Average	48.6	51.3	54.0	57.2	57.9	53.3	53.7
Producer Prices – Energy	59.3	62.6	65.6	68.7	69.4	58.8	63.8
Consumer Prices – Energy	38.6	41.0	43.0	44.6	45.2	39.0	41.8

Producer energy price index assumes 1982 = 1.00

Consumer energy price index assumes 1982-84 = 1.00

Source: DRI

The costs of meeting the Kyoto Protocol objectives would have substantial negative impacts on the US economy.[2] The material evaluated suggests that the target of reducing US greenhouse gas emissions by 2008-2012 could reduce the level of national output by 1.6% or more annually in the short-run, measured against the base case of no policy change. Because of the implied increases in real energy costs, consumption could fall even more, at least 2.2% annually (Table 3).

Table 3. Costs of Kyoto Protocol Policies
Summary of Key Impacts

Factor/Year	*Base Case*	*Kyoto Protocol*	*Percent Change*
Real GDP (bil $, base 1992)			
2010	9,428	9,273	-1.6
2020	10,865	10,836	-0.3
Consumption (bil $, base 1992)			
2010	6,346	6,203	-2.2
2020	7,599	7,555	-0.6
Total Employment (mil)			
2010	156.5	155.7	-0.5
2020	162.2	162.0	-0.1
Effective Non-Residential Capital Stock (bil $, base 1992)			
2010	10,993	11,116	1.1
2020	14,588	15,320	5.0

Source: DRI

Carbon emission constraints would be expected to increase prices, especially for coal and natural gas (Table 4). The higher prices in turn would lead to the substitution of capital for energy, and stimulate investment in energy conserving automobiles, houses and industrial operations. The result could be an increase in capital stock by 2020, boosting employment in some industries while jobs are lost in others.

The DRI/McGraw Hill model (like most econometric models) assumes that the United States will continue to purchase most of its imports from other developed countries which also will limit carbon emissions. However, higher energy prices will increase the competitiveness of exporters based in unaffected, lower-wage developing countries, who will capture a growing share of the US market as a result. This likely would expand the US trade deficit as rising energy prices make imports more attractive and US exports less competitive.

---

[2] This section depends on the DRI/McGraw-Hill model of the US economy. Current DRI estimates of economic impacts of energy taxes have been modified somewhat from June 1997 estimates used in previous reports. Current estimates assume somewhat greater capacity of US firms to anticipate regulations to be imposed in future years, and somewhat lower carbon taxes and smaller economic impacts as a result.

Table 4. Energy Price Comparisons

Base Case	***2010***	***2020***
Implicit Price of Carbon ($1997)	0	0
Gasoline-Retail ($/gallon)	1.32	1.49
Coal-Electric Utility ($/mmBtu)	1.17	1.10
Natural Gas-Utility ($/mmBtu)	2.48	2.97
Electricity (cents/kWh)	5.46	5.35
Kyoto Protocol		
Implicit Price of Carbon ($1997/ton)	177	193
Gasoline-Retail ($/gallon)	1.71	1.90
Coal-Electric Utility ($/mmBtu)	5.92	6.23
Natural Gas-Utility ($/mmBtu)	5.23	5.67
Electricity	8.41	8.20
Change From Base	*pct*	
Gasoline	29.5	27.5
Coal	406.0	466.4
Natural Gas	110.9	90.9
Electricity	54.0	53.3

Source: DRI

II. Impacts on the Agriculture Sector

The US agriculture sector is among the world's most advanced and efficient. The nation has uniquely favorable soils and climate, and claims many of the world's most productive farms, the result of the very high priority that US public policy has placed on agricultural productivity since the earliest days of the Republic. More recently, however, most investment in development of the sector has been private, in response to favorable returns from successful competition in growing world markets. Today, US producers are competitive in most world markets, with the exception of those still dominated by government policies (such as dairy or peanuts), or those for which the US climate provides no comparative advantage (e.g., coffee, bananas).

US producers are competitive in world markets because farms are productive, but also because the marketing infrastructure is highly efficient and marketing costs relatively low.[3] As the sector has evolved with the rapid adoption of new technology, it is both highly capital and energy-intensive. Energy use is both direct and indirect, including the fuel and lubricants for machinery and vehicles, the natural gas used to dry crops and pump irrigation water and the electricity used in an enormous variety of uses. Moreover, in addition to the energy consumed directly on each farm, farm production inputs (especially fertilizers and pesticides) contain very large energy components.[4]

Economics of US Agriculture

The US agricultural system is extremely complex, and sensitive to economic changes. Farmers buy over $185 billion worth of inputs and services and sell over $218 billion worth of products and services. They have received net cash income ranging between $50.7 billion and $60.5 billion over the past five years. The US system also is deeply integrated in the world economy, and regularly exports more than $50 billion worth of agricultural products, making exports the fastest growing market for US food and fiber products.

The US system is heavily dependent on highly sophisticated energy sources, both for its direct operations, and in the form of inputs for the system. This analysis examines in detail each of the major production cost components in terms of their energy dependence and the likely impacts of major cost increases from rising energy prices. Then, it examines likely impacts of higher energy costs on farm revenues, and then estimates net macro impacts for the sector.

This is a highly simplified analysis, intended to identify major areas of impacts rather than provide point estimates. In fact, the impacts of energy price increases would depend on the time period over which they were imposed, the availability of alternative energy sources, and the development of more efficient machines, fertilizers and other products. Measurement of such impacts is beyond the scope of this analysis. Instead, for each area of farm expenditure and receipts, an estimate is made of the importance of energy or fuels, expected price changes are derived from the DRI macro analysis, estimates of changes in use are made based on the size of the cost increase, and these impacts are summed into a general expenditure impact estimate that is applied to projected 1998 farm estimates. Clearly, such highly aggregated estimates are merely indicative of the size and direction of likely impacts, rather than specific estimates.

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[3] Marketing costs, as used here, are those USDA includes in its concept of the Food Marketing Bill – roughly those costs between the farm gate and the consumer.

[4] Economic Research Service, ***Energy Use on US Farms, 1991,*** an internal evaluation of energy use by US agriculture.

Production Expenses

Farmers will spend an estimated $185 billion in 1998 to produce food and fiber (Table 5). The largest category of expenses includes basic operating costs such as marketing, storage and transportation, machine hire, repair and maintenance, etc., which amounted to just over 32% of the total. Farm-origin inputs is the next most important category with nearly 24% of the total, followed by overhead costs such as rent and taxes (22%). Manufactured inputs such as fertilizers and pesticides account for 15%, while interest costs add an additional 7% to total production expenses.

Table 5. Farm Production Expenditures, 1990-98

Item	*1990*	*1992*	*1994*	*1995*	*1996*	*1997*	*1998*	*1998/90*
				bil $				*(pct)*
Feed Purchased	20.4	20.1	22.6	23.8	25.2	25.2	24.3	19.2
Livestock & Poultry Purchased	14.6	13.6	13.3	12.3	11.1	14.0	13.3	(9.2)
Seed Purchased	4.5	4.9	5.4	5.5	6.1	6.4	6.3	39.4
Farm Origin Inputs	39.5	38.6	41.3	41.6	42.4	45.6	43.9	11.0
Fertilizer & Lime	8.2	8.3	9.2	10.0	10.9	10.8	10.9	32.8
Fuel & Oils	5.8	5.3	5.3	5.4	5.7	5.7	5.6	(3.3)
Electricity	2.6	2.6	2.7	3.0	3.2	3.1	3.1	19.2
Pesticides	5.4	6.5	7.2	7.7	8.5	8.7	8.7	62.3
Manufactured Inputs	19.4	20.1	21.7	26.1	28.3	28.3	28.3	46.2
Short-Term Interest	6.7	5.4	6.0	6.7	6.9	7.0	7.1	6.7
Real-Estate Interest	6.7	5.8	5.9	6.0	6.4	6.4	6.5	(3.6)
Total Interest Charges	13.4	11.2	11.8	12.7	13.3	13.4	13.6	1.5
Repair and Maintenance	8.6	8.5	9.2	9.5	10.3	10.7	10.8	26.3
Contract & Hired Labor	14.1	14.0	15.3	16.3	17.3	18.2	18.7	32.5
Machine Hire & Custom Work	3.6	3.8	4.8	4.8	4.7	4.9	4.8	34.8
Mktg, Storage, Transportation	4.2	4.5	6.7	7.2	6.8	7.2	7.2	71.0
Misc Operating Expenses	16.5	16.5	19.7	18.3	18.0	18.1	17.8	8.2
Other Operating Expenses	46.9	47.3	55.7	56.1	57.1	59.1	59.3	26.5
Capital Consumption	18.1	18.3	18.8	18.9	18.9	19.0	19.0	4.8
Taxes	6.0	6.2	6.7	6.7	6.8	7.0	7.1	18.5
Net Rent	10.1	10.8	11.5	12.0	14.3	14.1	13.8	36.8
Other Overhead	34.2	35.3	37.0	37.6	40.0	40.1	39.9	16.6
Total Production Expenses	153.4	152.5	167.4	174.1	181.1	186.5	185.0	20.6

The national production cost level has been changing substantially during the 1990s, with the total rising substantially, nearly 21%. Much of the increase was for the largest category, basic operating expenses, which increased $12.4 billion (nearly 27%) during the period. However, costs of manufactured inputs increased $8.7 billion, over 46%, and the remaining major cost categories also have seen increases through the 1990s. The total increase in production costs was $31.6 billion, with farm-produced inputs accounting for only $4.6 billion of this cost growth.

A major reason for the increase in production costs is growth in the size of the sector, especially after 1996 when the Federal Agricultural Improvement and Recovery (FAIR) Act removed virtually all federal controls on production.[5] By 1998, land in crops had increased just over 10% from 1990, while production of most crops has increased even more rapidly, particularly energy-intensive crops such as corn (1997 relative to 1990):

Corn	+23%
Wheat	-10%
Soybeans	+45%

Energy Use on Farms

Direct Energy Use

US farmers used about 0.9% of all gasoline and 12% of motor diesel fuel in their production operations in the early 1990s based on the latest survey data available.[6] On-farm operations use about 2.7% of the liquefied petroleum gas, 0.3% of the natural gas, and 1.6% of the electricity consumed nationally. Just over 53% of total agriculture-related energy use is directly on farms, while the remainder is indirect, used in the manufacture of agricultural inputs such as fertilizer and pesticides (Table 6).

Table 6. Energy Use by US Farms, 1991

	***Amount* (trillion Btu)**	***Share* (%)**
Direct		
Liquid fuel		
Gasoline	125	8.6
Diesel	388	26.8
LP Gas	55	3.8
Other		
Natural Gas	57	3.9
Electricity	149	10.3
Indirect		
Fertilizer	561	38.7
Pesticides	115	7.9
Total	1450	100.0

Source: *Energy Uses on US Farms*, ERS, USDA, 1993

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[5] The chief exception is the Conservation Reserve Program which pays producers under ten-year contracts to retire from crop production land considered vulnerable to erosion.

[6] Economic Research Service, ***Energy Use on US Farms, 1991***, page 1.

In general, gasoline is used primarily in farm trucks and older harvesting equipment, and is the chief fuel used on smaller farms. Its use by farmers has fallen about 40% since the mid-1970s. Most commercial farms use primarily diesel tractors and trucks. And, diesel is used in most heavy-duty field operations because of its fuel efficiency (and accounts for about 28% of total energy use). The shift from gasoline powered equipment to diesel has resulted in an overall decrease in fuel use because reduced-tillage practices have become widespread at the same time farmers were switching fuels.

Liquefied petroleum gas and natural gas are used primarily to dry crops, heat animal structures and power irrigation pumps. Electricity also is used for the same purposes.

Indirect Energy Use

Chemical fertilizers are the most energy intensive farm input, and account for almost 40% of the total energy required in farm production. The fertilizer industry used 561 trillion Btus of natural gas and other energy to manufacture fertilizer for farm use in 1991 (fertilizer use consumes about 2% to 3% of total natural gas consumption in the United States). About 115 trillion Btus of petroleum were used to make pesticides and herbicides in 1991. The extensive utilization of these products thus accounts for the indirect energy use of nearly 47% of the total in 1991.

Energy use varies considerably by crop and livestock type (Table 7). For example, rice is the most intense energy using crop (35% of variable costs) because of its tillage requirements, fertilizer needs, and irrigation and drying needs. Cotton also ranks high because of its large fertilizer and pesticide needs and ginning requirements. Field crops generally require greater energy than fruits, vegetables and livestock (in part because of the accounting procedures – most of the energy used in livestock production and fattening is contained in grain products and appears directly in the energy budgets for those crops). The energy expenditures for US agriculture in 1991 was $7.53 billion.

Table 7. Energy Costs as Share of Total Variable Costs, 1984-91 Average

Crop	*Share*
	(pct)
Rice	35
Cotton	25
Peanuts	24
Wheat	24
Corn	23
Soybeans	21
Hogs	16
Broilers	13
Turkeys	12
Dairy	11

Source: *Energy Uses on US Farms*, ERS, USDA, 1993

Impacts of Kyoto Protocol Emission Controls

The impacts of emission controls on agriculture will depend on the specific controls used, their direct impacts on farm production costs, and importantly on their impacts on the overall economy. Assuming the Protocol's target of limiting emissions in 2008-12 at 93% of the 1990 level and the emission permit costs estimated by DRI, key economic impacts affecting the agriculture sector would be: sharply higher costs of gasoline, natural gas, electricity and the high-energy products that depend on basic energy items, with inflation adjusted gasoline prices up 29.5% by 2010, natural gas prices up 110.9% and electricity prices up 54%. These impacts would be both immediate and direct for fuels such as gasoline, diesel, natural gas, and for direct energy purchases such as electricity.

While fuel and oil prices would increase immediately in response to the imposition of an emissions tax, costs for a broad range of agricultural inputs would be expected to increase, as well, since these are highly energy-intense. For example, natural gas typically amounts to 75% of the cash cost of manufacturing anhydrous ammonia, a basic component of nitrogen fertilizers. For nearly all manufactured farm inputs, energy costs are equivalent to 50% or more of the cash production costs. Thus, while fuel and oil account for only 3% of agricultural production costs in 1998, fertilizer accounts for nearly 6% and pesticides nearly 5%, both extremely energy intensive inputs, bringing the total for manufactured inputs to over 15% of cash costs (Tables 8 and 9).

Table 8. Share of Specific Inputs in Total Production Expenses

Item	*1990*	*1998*
	pct	
Feed Purchased	13.3	13.1
Livestock & Poultry Purchased	9.5	7.2
Seed Purchased	2.9	3.4
Farm Origin Inputs	25.8	23.7
Fertilizer & Lime	5.3	5.9
Fuel & Oils	3.8	3.0
Electricity	1.7	1.7
Pesticides	3.5	4.7
Manufactured Inputs	12.6	15.3
Short-Term Interest	4.3	3.8
Real-Estate Interest	4.4	3.5
Total Interest Charges	8.7	7.4
Repair and Maintenance	5.6	5.8
Contract & Hired Labor	9.2	10.1
Machine Hire & Custom Work	2.3	2.6
Mktg, Storage, Transportation	2.7	3.9
Misc Operating Expenses	10.7	9.6
Other Operating Expenses	30.6	32.1
Capital Consumption	11.8	10.3
Taxes	3.9	3.8
Net Rent	6.6	7.5
Other Overhead	22.3	21.6
Total Production Expenses	100.0	100.0

Table 9. Direct Farm Energy Expenditures, 1991

Item	*Amount*	*Share*
	bil $	*pct*
Gasoline	1.50	19.9
Diesel	2.34	31.1
LP Gas	0.44	5.8
Electricity	2.33	30.9
Natural Gas	0.27	3.6
Other	0.65	8.6
Total	7.53	100.0

Source: *Energy Use on US Farms*, ERS, USDA, 1993

In addition to manufactured inputs, there are four major categories of farm production costs. Other operating expenses are the most important, including repair and maintenance, hired labor, machine hire and custom work and miscellaneous operating expenses, and account for 32.1% of total production costs in 1998. Farm-made inputs add nearly 24%, while interest adds over 7%. Other overhead, including taxes, net rent and capital consumption accounts for about 22%. And, while the manufactured inputs category would be the most sensitive to increased energy costs, each of the categories would be expected to be affected somewhat either by the direct increase in energy costs or in the indirect economic affects associated with the change.

For each of the four major subcategories of production cost, based on USDA estimates of 1998 expenditures, an estimate was made of the share attributed to energy, the likely use response to higher prices as producers modify operations to control costs as much as possible, and the impact on subcategory expenditures of the DRI/McGraw Hill estimates of energy cost increases. These are discussed in the following sections and summarized in Table 10.

Manufactured Input Expenditures

The most immediate impact of an increase in gasoline prices of 30% would be an increase in fuel and oil costs, with gasoline and diesel increasing by the full amount. In response, farmers would be expected to reduce fuel use slightly (perhaps 3%), so that the net impact would be a 28% increase in fuel and oil expenses (adding $1.5 billion to the expected $5.6 billion for 1998).

Similarly, the 1998 expenditure of $10.9 billion for fertilizer would be increased sharply by the expected enormous increase in natural gas prices, perhaps by $5.7 billion (52%), assuming a 65% energy component and a 20% reduction in use of lime and fertilizer in response to the cost increase. Pesticide costs likely would face a smaller increase, assuming an energy cost increase averaging 55%, a 70% energy cost component and a 5% reduction in use. However, the large increases in energy used in the manufacture of these products could be expected to increase costs by as much as 43% – more than $11.3 billion at 1997 expenditure levels.

Table 10. Impacts of Energy Cost Increases on Farm Expenditures, 2010

Item	*Assumptions:*					
	Energy Component	*Price Response*	*Cost Change*	*Exp Net Response*	*Exp 1998*	*Cost Impact*
		%		*%*	*bil $*	
Fertilizer & Lime	65.0	-20	1.00	52	10.9	5.7
Fuel & Oils	95.0	-3	0.30	28	5.6	1.5
Electricity	95.0	-3	1.00	92	3.1	2.9
Pesticides	70.0	-5	0.50	33	8.7	2.9
Manufactured Inputs					28.3	13.0
Feed Purchased	12.0	-5	0.35	4	24.3	1.0
Livestock and Poultry Purchased	7.5	-1	0.35	3	13.3	0.3
Seed Purchased	15.0	-1	0.35	5	6.3	0.3
Farm Origin Inputs					43.9	1.6
Short-Term Interest				-9.1	7.1	-0.6
Real-Estate Interest				-2.2	6.5	-0.1
Total Interest Charges					13.6	-0.8
Repair and Maintenance	5.0	-2	0.50	2	10.8	0.3
Contract & Hired Labor	0.0		0.30	0	18.7	0.0
Machine Hire & Custom Work	9.0	-2	0.30	3	4.8	0.1
Mktg, Storage, Transportation	20.0	-2	0.30	6	7.2	0.4
Misc Operating Expenses	12.0	-2	0.50	6	17.8	1.0
Other Operating Expenses					59.3	1.9
Capital Consumption				3.8	19.0	0.7
Taxes				4.5	7.1	0.3
Net Rent				-3.7	13.8	-0.5
Other Overhead					39.9	0.5
Total Production Expenses					185.0	16.2

Farm Origin Inputs

These include primarily feed grains and livestock, but also seeds. An increase in their production costs would result in a higher purchase cost, as well. The energy cost component in grain production is large – about 23% for corn, for example, and ranging from 12% to 18% for livestock.[7] For the sector, it is assumed that direct production costs would include most of the costs of producing livestock and feed and are included directly in cost of sector operations.

There are significant costs beyond the direct operations costs such as handling, processing and transportation that become additional costs of farm-produced inputs that are affected by energy prices. The energy cost component is assumed to be 12% for feed, 7.5% for livestock and poultry and 15% for seed. These relatively low energy components imply small cost increases and low consumption responses (5% for feed use, 1% for livestock and seed purchases). And, assuming an average energy price increase of 35% (for the composite use of gasoline, diesel and natural gas) as a result of the Kyoto Protocol, expenditures likely could increase 4% for feeds, 3% for livestock and 5% for seed for a total of $1.6 billion, an increase of nearly 4% in expenditures for farm produced inputs.

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[7] Economic Research Service, ***Energy Use on US Farms, 1991***, page 10.

Other Operating Expenses

This is a very large and important category, including five types of activities with varying degrees of reliance on energy:

• Repair and maintenance	5% energy component (assumed)
• Contract and hired labor	0% energy
• Machine hire and custom work	9%
• Marketing, storage and transportation	20%
• Miscellaneous operating expenses	12%.

For each of these categories, the reduction in use resulting from the Kyoto-related cost increase is assumed to be small at only 2%. For repair, maintenance and miscellaneous operating expenses, the increase in energy costs is assumed to represent a composite gasoline-diesel/natural gas cost increase (55%). This figure is somewhat more heavily weighted toward natural gas than farm-produced inputs, for which energy costs represent primarily gasoline-diesel costs. Thus, the net expense increase resulting from the increases in energy costs is assumed to range from 6% for marketing, storage and transportation to 0% for contract and hired labor, and to average 3.2% for the category, an increase of $1.9 billion from 1998 level expenses.

Interest

The DRI analysis assumes that interest rates would be reduced by monetary policy interventions, in response to the price and unemployment increases resulting from the emission constraints. They project 10-year T-bill rates of 6.02% in 2010 in their base case, while under the Kyoto Protocol, the rate is forecast at only 5.89%. In such a case, agricultural interest costs could decline modestly, both as borrowing is reduced in response to cost increases and because of the lower rates. Assuming, as DRI does, that by 2010, short-term rates could decline 9.1% and longer-term rates 2.2%, interest costs for the sector would decline about $800 million (5.6%).[8]

Other Overhead

This category includes taxes, net rent and capital consumption. Experience in periods of price inflation indicates that higher taxes likely would be stimulated by the assumed sharp increases in energy costs, by perhaps 4.5%. Rents could decline as the reduced profitability of the sector cuts the demand for rental land, by an assumed 3.7%. Capital consumption also would be expected to increase as costs increase, perhaps by 3.8% by 2010.

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[8] The gap between long-term and short-term interest rates currently is extraordinarily low, so it is quite likely that short-term interest rates could be more strongly affected by the economic effects of emissions reductions, plunging much farther than long-term rates, thus returning interest rate spreads to more normal levels.

Impacts on Farm Sector Revenues

A key aspect of the impact of emission constraints likely would be reduced sales of agricultural products, especially to foreign markets. The degree of such impacts depends on the international agreement under which emissions would be constrained. If, for example, developing nations that are actively competing for key markets are exempt from emission constraints or have a longer transition period than do developed countries, then the position of US producers in world export markets could be very markedly altered.

Farm Income

US farm cash receipts were just over $226 billion in 1997, the result of steady growth averaging 2.8% per year through the 1990s (Table 11). Sales of crops and livestock account typically for 90% of the total, while farm-related income averages between 4% and 5% of the total. Direct government payments make up much of the remainder, but these are declining fairly rapidly and are only 3.2% of total receipts in 1998 (Table 12).

Table 11. US Farm Income

								Ann. % Change	
	1990	*1992*	*1994*	*1995*	*1996*	*1997*	*1998(f)*	*1990-97*	*1997-98*
Farm Receipts				*bil $*					
Crops 1/	80.3	85.7	93.1	100.7	109.4	110.4	107.7	4.7	-2.4
Livestock	89.2	85.6	88.2	87.0	92.9	96.6	95.0	1.1	-1.7
Farm Related	8.2	8.2	9.2	10.1	11.0	11.4	10.9	4.8	-4.4
Direct Govt. Payments	9.3	9.2	7.9	7.3	7.3	7.9	7.4	-2.3	-6.3
Nonmoney Income 2/	7.9	7.6	9.2	9.8	10.2	10.9	11.6	4.7	6.4
Inventory Adjustment	3.3	4.2	8.2	-3.9	2.7	-0.1	-1.5		
Gross Cash Income	187.0	188.7	198.4	205.1	220.6	226.3	221.0	2.8	-2.3
Gross Farm Income	198.2	200.5	215.8	211.0	233.5	237.1	231.1	2.6	-2.5
Cash Expenses 3/	134.2	133.6	147.6	153.9	160.6	165.8	164.8	3.1	-0.6
Total Expenses	153.4	152.9	167.5	174.2	181.3	186.4	185.6	2.8	-0.4
Net Cash Income	52.9	55.1	50.7	51.2	59.9	60.5	56.2	1.9	-7.1
Net Farm Income	44.8	47.5	48.3	36.7	52.2	50.7	45.5	1.8	-10.3
Deflated (1987 $)	39.5	39.3	38.1	28.3	39.5	37.6	33.3	-0.7	-11.5

(f) = forecast

1/ Includes net CCC loans.

2/ Value of home consumption of self-produced food and imputed gross rental value of farm dwellings.

3/ Excludes capital consumption perquisites to hired labor, and farm household expenses.

Total may not add due to rounding.

Source: *Agricultural Outlook*, ERS, USDA, June-July 1998.

Table 12. Share of Farm Income

	1990	*1998*	*1998/90*
		percent	
Farm Receipts	89.7	92.4	3.1
Crops	40.5	46.6	15.0
Livestock	45.0	41.1	-8.7
Farm Related	4.1	4.7	14.0
Direct Govt. Payments	4.7	3.2	-31.8
Gross Cash Income	94.3	95.6	1.4
Non-Money Income	4.0	5.0	25.9
Value of Inventory Change	1.7	-0.6	
Gross Farm Income	100.0	100.0	

When inventory values and non-money income are considered, all farm receipts are forecast at just over $231 billion in 1998, up nearly 17% since 1990. However, expenses also have grown moderately during the 1990s, and cash production costs increased from $134 billion in 1990 to $165 billion this year, up nearly 23%. Thus, in spite of the strong growth in sales, the sector's net cash income has varied, ranging between $50.7 and $60.5 billion over the past five years.

Crop sales typically provide the largest share of farmer's cash receipts, between 40% and 47% of total farm income during the 1990s. Livestock sales are slightly less important, averaging about 42% of total income. In the past, government payments have been very important to the sector, but have averaged only 4.1% of total income since 1990. Under the 1996 FAIR Act, direct government payments are scheduled to continue to decline, and to end by 2002. Non-money income also contributes 4% to 5% of income in a typical year, while shifts in inventory value depend primarily on production levels and market outlook and have been both negative and positive during the period, ranging from -2% to 4% of income.

Importance of Foreign Markets

While the large domestic market continues to be the focus of the major agricultural sectors, US exports are growing and have become increasingly important across the sector (Table 13). For each of the major commodities, export markets have been the principal growth area of the 1990s and are expected to be the primary source of growth in the future. The major exception is wheat, which faces strong and growing pressure from overseas producers, who in many cases distort markets through production and export subsidies.

Table 13. Importance of Foreign Markets, Selected Commodities

	1992			1998(f)			Change
Commodity	*Total use*	*Export*	*Share*	*Total use*	*Export*	*Share*	*in Exports*
			million bushels				*(pct)*
Corn	8,471	1,663	20	9,175	1,625	18	-2
Cotton (mil bales)	14,838	4,869	33	16,749	5,600	33	15
Wheat	2,479	1,354	55	2,276	1,046	46	-23
Soybeans	2,176	775	36	2,629	845	32	9
			billion pounds				
Beef	24,118	1,323	5	25,837	2,190	8	66
Pork	17,419	407	2	17,811	1,261	7	210
Broilers	19,489	1,487	8	22,556	5,200	23	250
Turkey	4,617	202	4	4,991	487	10	141

Revenues from world market sales were $57.2 billion in 1997, but are projected to decline slightly to $55.0 billion in 1998, still the third-highest level on record (Table 14 and Appendix Table A). Key US trade patterns relevant to this analysis include:

Table 14. Trade Balance

Item	*1990*	*1991*	*1992*	*1993*	*1994*	*1995*	*1996*	*1997*	*1998 (f)*
					billion $				
Exports									
Agricultural	39.4	39.2	42.9	42.6	45.7	55.8	60.4	57.2	55.0
Nonagricultural	335.8	361.6	389.3	396.6	436.9	492.3	521.7	586.0	n/a
Total 1/	375.2	400.8	432.2	439.2	482.6	548.1	582.1	643.2	n/a
Imports									
Agricultural	22.8	22.7	24.6	25.0	26.8	30.0	33.6	36.3	37.5
Nonagricultural	468.2	460.3	500.6	549.9	630.5	709.6	756.9	828.4	n/a
Total 2/	491.0	483.0	525.2	574.9	657.3	739.6	790.5	864.7	n/a
Trade Balance									
Agricultural	16.6	16.5	18.3	17.6	18.9	25.8	26.9	21.0	17.5
Nonagricultural	-132.4	-98.7	-111.3	-153.3	-193.5	-217.3	-235.2	-242.4	n/a
Total	-115.8	-82.2	-93.0	-135.7	-174.6	-191.5	-208.3	-221.5	n/a

(f) = forecast.
1/ Domestic exports including Department of Defense shipments.
2/ Imports for consumption (customs value).

Source: *Agricultural Outlook*, ERS, USDA, June-July 1998

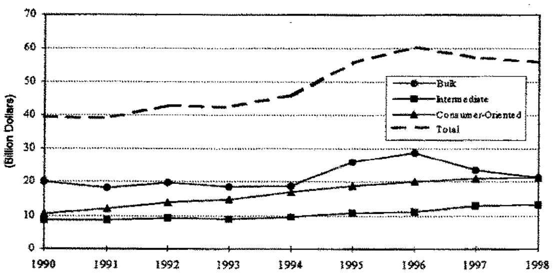
- Developed countries continue to buy substantially more from the United States than do developing countries ($2.7 billion more in 1997), and that margin likely will widen this year.

- Exports to both developed and developing countries are highly competitive. Increases in production costs in response to emission constraints could provide a significant advantage for competing developing countries who would have less stringent emission constraints. The result could be a significant competitive disadvantage for US producers.

- High value exports could initially face fewer competitors than bulk commodities, since developing countries are less likely to have both surpluses of basic commodities necessary to support production of high value products and access to the more sophisticated processing sectors necessary to produce competitive quality products.

- Increased production costs for the United States likely would stimulate competing production in areas with underused production resources, especially in parts of Latin America, Asia, and Africa, where substantial amounts of land are available for development. The result could be a significant decline in US export sales, especially for sales of bulk commodities, which typically exceed $20 billion (Chart 1). While it is beyond the scope of this project to estimate objectively the likely magnitude of such a loss of markets, it is not unreasonable to estimate that it could be as large as 8% of 1998 export sales of bulk commodities, 5% of consumer oriented export sales and 7% of intermediate commodities, for a total loss in the range of 6% to 7% of total exports – a very significant $3.6 billion reduction from a $55 billion sales level.

Chart 1. US Exports: Bulk, Intermediate and Consumer-Oriented Products



Domestic Market Revenues

Sharply higher US production costs would serve to reduce demand and sales in domestic food and fiber markets. Competing imports would enter from developing countries that do not face similar increases in production costs, and consumers would reduce overall consumption in response to declines in GDP (and disposable income) and employment resulting from emissions constraints. For example, if Mexico and other Latin American neighbors are either exempt from emission controls (as agreed under the Kyoto Protocol), highly mobile US capital likely will move to nearby countries such as Mexico, Guatemala and throughout the Caribbean to establish and expand production facilities for certain food products which would be shipped to the United States – especially, fruits and vegetable products. As a result, developing countries not only would expect to compete increasingly advantageously for third country markets, but they likely would increase their sales in the United States, as well. Shifting the US production cost structure higher by the emissions constraints cost could well mean that some domestic food production capacity would be exported to offshore locations not subject to the same constraints.

Still, the largest markets for US farm products are the domestic ones, and these would be diminished significantly by declines in consumer income. Because US incomes are high by world standards, and consumption levels of food already large, consumers change consumption patterns relatively slowly when incomes shift. And, their responses to changes in incomes are highly complex, and vary widely by product (Table 15). For example, for beef, each 10% change in income is associated with nearly a 4% change in consumption – with responses about the same for fish and cheese. The consumption response for pork is significantly greater, likely reflecting both the importance of very high value pork products (ham and sausage), and its role as a fast-food product. Fruit juice (and fruits and vegetables, in general) is quite sensitive to changes in consumer income, while consumption of wheat flour and potatoes, for example, change very little as income shifts.

Table 15. Consumption Responses to Income Changes – Indicative Food Items

Expenditure response to a 1% increase in income:

Food	*Change (%)*
Beef and Veal	0.39
Pork	0.66
Fish	0.43
Cheese	0.42
Butter	0.54
Other Fats and Oils	0.49
Wheat Flour	0.13
Potatoes	0.11
Fruit Juice	0.36
Sugar	0.006

Source: Huang, K.S., *A Complete System of US Demand for Food*, USDA, ERS Technical Bul. No. 1821, 1993

Without attempting to estimate specific shifts in consumption of individual foods, it is clear that a reduction in annual disposable income as great as the nearly 2.4% caused by Kyoto Protocol constraints on emissions by 2010 would have a significant reduction in US demand for food.

Such a reduction in buying power would lead consumers to either reduce food consumption, or, if production levels were unchanged, producers would be required to reduce prices to clear their markets. And, assuming an overall food income elasticity of demand of about 0.35%, a 2.4% decline in income with no change in production would be expected to diminish prices and revenues by about 0.84% – $1.7 billion from 1998 sales of crops and livestock of $202.7 billion (reference Table 11).

Thus, the combined reduction in exports of $3.6 billion, plus a domestic income effect of $1.7 billion could mean a $5.3 billion reduction in farm receipts, some 2.4% below the estimated 1998 level of $221 billion.

Impact on Farm Income

While estimates of impacts on the individual sectors can only be approximate, it is very clear that emission constraints that increase energy costs sharply – as the DRI evaluation concludes those under consideration would do – would sharply boost US agricultural production costs. It also is highly likely that increases in cost not shared by developing countries would make the food producers among them much more competitive with US products in third country markets and for the domestic market, as well.

The foregoing analysis implies that the increased market competition could reduce agricultural revenues by perhaps $5.3 billion (-2.4%), while increasing production costs more than 8% (Table 16). And, while such shifts would appear quite moderate in response to a more than 30% increase in gasoline and diesel costs (with greater increases for other energy sources), they would sharply reduce farmers' incomes – with net farm income down nearly 53% from 1998 levels.

Table 16. Farm Income Impacts as a Result of the Kyoto Proposal

Item	*1998*	*Impact*	*Adjusted*	*Change*
		billion $		(pct)
Farm Receipts	214	-5.3	209	-2.3
Direct Govt. Payments	7		7	0.0
Gross Cash Income	221		216	-2.3
Gross Farm Income	231		226	-2.3
Cash Expenses	165	16.2	181	9.6
Total Expenses	186	16.2	202	8.6
Net Cash Income	56	21.5	35	-38.9
Net Farm Income	46	21.5	24	-52.8

III. Indicative Farm Impacts

Impacts on Farm Structure

US farm structure is a somewhat amorphous concept, variously defined, but focuses on how farms of different sizes and types organize their natural, financial and human resources. One key distinction is between commercial and non-commercial farms. Commercial farms are those with annual gross sales greater than $100,000, and now account for only 16% of total farms, but have more than 75% of the sector's total sales.

Most US farms are small, non-commercial and usually family owned and operated. They account for nearly 84% of all US farms and have an average size of nearly 470 acres (Table 17). Small, non-commercial farms produce a minor share of total US food and fiber. They are typically located near more densely-settled, urban areas where non-farm employment opportunities are more plentiful. They do not significantly affect the local economy's income and employment but provide an important non-economic presence, since the primary occupation of most of these farm operators is not farming. They typically hold a full time, non-farm job and work part time on the farm or are semiretired.

Small, non-commercial farm businesses often operate at a loss, with farm expenditures greater than receipts from commodity sales, government payments, and farm related income. Family well-being for these small farms depends primarily on off-farm income, and their average total income in most years is commensurate with that of all US families. Small farms also are often found in areas that are relatively less conducive to large-scale crop production. Thus, these farms are disproportionately livestock farms, accounting for 85% of all livestock operations and 92% of cattle operations.

Table 17. Farm Sector Overview (Numbers and Size)

	1980	*1985*	*1990*	*1995*	*Annual Change:* *1985-90*	 *1990-95*
Farm Numbers		*1,000 units*			*percent*	
Commercial	271	326	321	341	-0.3	1.0
Other	2169	1966	1819	1729	-1.3	-0.8
Total	2440	2292	2140	2070	-1.1	-0.6
Land in Farms (mil acres)	1042	1012	987	972	-0.4	-0.3
Average Farm (acres)	426	441	461	469	0.7	0.3
Commercial Farm (acres)	1549	1575	1550	1564	-0.3	0.1

Source: USDA/US Bureau of the Census

Just as commercial operations have become both more numerous and more important across the sector, diversified farms have become much less important as large, specialized operations—those with one commodity that accounts for more than 50 percent of the production—have increasingly come to dominate the sector. By the end of the 1980s, specialized farms controlled nearly three-fourths of all farm business assets and about the same proportion of the debt. The basis of this trend is the significantly different returns realized by commercial versus non-commercial operations.

- Farm numbers are declining, from 2.4 million in 1980 to just under 2.1 million in 1995. All of the decrease has been in non-commercial farms (less than $100,000 in sales).

- The majority of US farms falls into the size class of 1-179 acres. In 1993, about 1.2 million farms were less than 180 acres in size. The size of the average US farm is growing, but relatively slowly (from 426 acres in 1980 to 464 acres by 1995). However, the size of the average commercial farm has been quite stable since 1980—about 1,564 acres.

- The nation's 341,000 commercial farms are very different from hobby farms. They are primarily moderate-to-small businesses (nearly 85% of these operations have between $100,000 and $499,000 annual gross sales), with cash receipts generally in the $168,000 to $363,000 range, and net cash income between $47,000 and $101,000. While larger operations from $500,000 to more than $1,000,000 in sales have incomes averaging almost $1.2 million, the core of US agricultural producers operate at sale and income levels quite similar to small and medium-sized businesses nationwide. And, they tend to be far more profitable than the small farms.

- The number of commercial farms has grown sharply since 1980, in part because of increasing prices and sales, but also reflecting larger operations of all types.

- The sharp increase in energy costs caused by the Kyoto Protocol likely would sharply reduce investment in agriculture, with the vast bulk of the adjustment falling on the smaller farm units. During the farm depression of the 1980s, the number and size of commercial units became stagnant, but numbers of smaller farms fell rapidly – more than 200,000 units between 1980 and 1985, and more than 350,000 units during the decade of the 1980s. Average farm size grew steadily as a result of these consolidations.

- Similar impacts would be expected from higher energy costs – with trends toward consolidation sharply accelerating, as numbers of smaller farms decline sharply.

Typical Farms

In the overall context of pressures on production costs and income, estimates of potential impacts of the farm level energy cost increases associated with emission constraints, five "typical" farm operations were evaluated, as well. These included:

- **Iowa corn-soybean operation, with 200 acres of corn and 200 acres of soybeans.** Kyoto-related energy cost increases could boost this farm's cash expenditures by 19% (or $13,090). They also could mean a possible yield decline of 5%, price reductions of 2%, and a 39% reduction in per acre net cash returns.

- **Mid-western farrow-to-finish hog operation with 200 sows.** This hog farm might experience a 16% increase in variable cash costs as a result of Kyoto-related energy cost increases, and its net losses could be increased considerably reaching nearly $95,000 under the scenario evaluated.

- **Upper-midwest dairy operation with 125 cows.** This dairy operation realized a return of $1.31 per cwt of milk sold under baseline energy costs. Kyoto-related energy cost increases could boost cash production costs nearly 13%, making cash returns negative and reducing profits from $27,576 to a loss of $10,527.

- **Great Plains 500-animal cow-calf operation.** In 1996, even at baseline energy costs, this operation lost $14.80 per cow. Kyoto Protocol emissions controls could boost total variable cash costs 8.3% and increases losses to nearly $60/cow.

- **Florida tomato operation, with 85 acres of tomatoes.** This tomato operation, despite extremely high production costs, realized $283,000 in net returns at baseline cost conditions. However, Kyoto-related energy cost increases could result in a reduction of nearly 50% in net returns per acre for a revenue decline for the farm to just under $145,000.

For each, the latest available USDA estimates of production costs were used to determine likely cost increases from the sharp increases in energy costs resulting from the Protocol and described in the preceding sections.

These operations are extremely different in their normal activities, with the corn-soybean farm concentrating solely on the production of cash grain and soybeans, the livestock farms concentrating solely on hogs, cows, and milk, and the tomato operation only on tomatoes. The only economic changes assumed were the energy cost increases, and these were assumed to have similar impacts on cost categories described for the national economy, with one notable difference. For the US agricultural sector, the bulk of the cost impact for feeds was assumed to take place when the feed grains were produced, with cost increases associated with feed and livestock purchases associated only with processing these grains into feeds, storing and moving them. The concept is similar to that of a diversified farmer who produces feed grains and then feeds them to livestock.

However, for the specialized farming operations, the assumption is that feeds are purchased so that the increased energy costs associated with both producing the feed grains and processing and handling the feeds would affect these costs. As a result, cost increases for feeds and livestock are assumed to be a somewhat greater share of estimated "normal" costs than can be seen at the macro level.

For each operation, net profits would be significantly affected by the economic impacts of emissions reduction measures (Tables 18, 19, 20, 21, and 22). For corn, variable cash costs were increased by 23% by the increased energy costs (nearly 30% for gasoline and diesel, 110% for natural gas), while soybean costs increased by 15% – a smaller amount because of the much lower per acre production costs associated with soybean production. For example, in the base production year, per acre costs for fertilizer for corn were nearly $56, while those for soybeans were less than $10. Total variable cash costs for corn were nearly twice those for soybeans, $153 per acre compared with just under $79.

Under the assumed conditions, this 400 acre farm had a net cash return of $56,274 (without government payments) under baseline energy cost conditions. With increased energy costs, the total cash expenditures increased 19%, yields declined 5% perhaps in response to lower use of fertilizer and chemicals, prices fell 2% in response to weaker international and domestic markets, and the net cash return per acre declined 39%.

Similar impacts were observed for each of the other operations, although the magnitude differs significantly. The 200-sow farrow-to-finish hog operation was realizing a small net loss of -$0.01 per cwt of hog produced at baseline energy costs in 1996, a year when feed costs were exceptionally high. After the increase in energy costs, variable cash costs were nearly 16% higher, and net losses were considerably higher – exceeding $9.00/cwt and reaching nearly $95,000 for the farm as a whole.

The dairy operation realized a return of $1.31 per cwt of milk sold (in 1996) under baseline energy costs. Energy cost increases would boost cash production costs nearly 13%, making cash returns negative (-$0.50 per cwt of milk). Consequently, total returns decline, reducing profits from $27,576 to a loss of $10,527.

In 1996, cattle prices were falling while feed prices were rising. Consequently, even at baseline energy costs, the average 500-cow Great Plains cow-calf operation lost $14.80 per cow that year. Under Kyoto Protocol emissions controls, total variable cash costs could rise 8.3%. With the resultant 3% decline in the value of output and the increased production costs, losses could increase to nearly $60/cow.

The Florida tomato operation sustained extremely high production costs ($10,170 per acre under the energy baseline case) but realized about $3,330 per acre net return – just over $283,000 for the 85-acre operation – at baseline costs. However, the assumed energy cost increases boosted cash expenses by 13%, while weaker markets reduced revenues per acre about 3%. The result was a reduction of nearly 50% in net returns per acre to just over $1,700, or a revenue decline for the farm to just under $145,000.

Table 18. North Central Corn-Soybean Operation, 1996 Conditions

	Corn				*Soybeans*			*Farm Total*		
Cash Expenses/Acre	***Cost***	***Impact***	***Adj Cost***	***Change***	***Cost***	***Adj Cost***	***Change***	***Cost***	***Adj Cost***	***Change***
	$/acre	*pct*	*$/acre*	*$/acre*	*$/acre*	*$/acre*	*$/acre*	*$*		*%*
Seed	23.76	0.06	25.19	1.43	16.11	17.08	0.97	7,974	8,452	6
Fertilizer, Lime, Etc.	55.97	0.52	85.07	29.10	9.72	14.77	5.05	13,138	19,970	52
Chemicals	27.18	0.35	36.69	9.51	26.16	35.32	9.16	10,668	14,402	35
Custom Services	9.1	0.03	9.37	0.27	4.04	4.16	0.12	2,628	2,707	3
Fuel, Lube, Electricity	13.98	0.29	18.03	4.05	8.22	10.60	2.38	4,440	5,728	29
Repairs	15.98	0.03	16.46	0.48	9.24	9.52	0.28	5,044	5,195	3
Hired Labor	6.77	0	6.77	0.00	5.02	5.02	0.00	2,358	2,358	0
Other Expenses	0	0	0.00	0.00	0.03	0.03	0.00	6	6	0
Total, Variable Cash	152.74		197.59	44.85	78.54	96.50	17.96	46,256	58,818	27
General Overhead	13.89	0.04	14.45	0.56	12.59	13.09	0.50	5,296	5,508	4
Taxes and Insurance	21.95	0.05	23.05	1.10	22.66	23.79	1.13	8,922	9,368	5
Interest	19.27	-0.02	18.93	-0.34	17.79	17.48	-0.31	7,412	7,282	-2
Total Fixed	55.11		56.43	1.32	53.04	54.37	1.33	21,630	22,158	2
Total Cash Expenses	207.85		254.02	46.17	131.58	150.86	19.28	67,886	80,976	19
Yield	127.1	-0.05	120.75	-6.36	37.6	35.72	-1.88	32,940	31,293	-5
Price (harvest, $/bu)	2.71	-0.024	2.64	-0.07	7.35	7.17	-0.18	2,012	1,964	-2
Value of Production	344.44		319.37	-25.08	276.36	256.24	-20.12	124,160	115,121	-7
Net Returns	136.59		65.35	-71.24	144.78	105.38	-39.40	56,274	34,145	-39

Based on 400 acre North Central Corn and Soybean Operations

Source: ERS, USDA

Table 22. Florida Tomato Operation, 1996 Conditions

	Per Acre					Per Farm		
Cash Expenses/Acre	***Cost***	***Impact***	***Adj Cost***	***Change***	***Change***	***Cost***	***Adj Cost***	***Change***
Operating	*$/acre*	*pct*	*$/acre*	*$/acre*	*%*	*$*		*%*
Seed	201.70	0.06	213.80	12.10	6	17,145	18,173	6
Fertilizer	284.00	0.5	426.00	142.00	50	24,140	36,210	50
Fumigant	427.50	0.35	577.13	149.63	35	36,338	49,056	35
Fungicide	208.66	0.35	281.69	73.03	35	17,736	23,944	35
Herbicide	84.67	0.35	114.30	29.63	35	7,197	9,716	35
Insecticide	329.00	0.35	444.15	115.15	35	27,965	37,753	35
Labor	370.08	0	370.08	0.00	0	31,457	31,457	---
Machinery, Repairs	221.70	0.03	228.35	6.65	3	18,845	19,410	3
Interest	140.95	-0.023	137.71	-3.24	-2.3	11,981	11,705	(2)
Miscellaneous	898.17	0.1	987.99	89.82	10	76,344	83,979	10
Total, Variable Cash	3166.43		3781.20	614.77	19	269,147	321,402	19
Land Rent	450.00	0.04	468.00	18.00	4	38,250	39,780	4
Machinery	110.10	0.15	126.62	16.52	15	9,359	10,762	15
Management	717.25	0.05	753.11	35.86	5	60,966	64,015	5
Overhead	896.57	0.02	914.50	17.93	2	76,208	77,733	2
Total Fixed	2173.92		2262.23	88.31	4	184,783	192,289	4
Harvest and Hauling	1190	0.20	1428.00	238.00	20	101,150	121,380	20
Packing	2240	0.12	2508.80	268.80	12	190,400	213,248	12
Containers	1120	0.05	1176.00	56.00	5	95,200	99,960	5
Selling	210	0.10	231.00	21.00	10	17,850	19,635	10
Organization Fees	70	0.00	70.00	0.00	0	5,950	5,950	---
Total Harvest/Mktg	4830		5413.8	583.8	12	410,550	460,173	12
Total Cash Expenses	10170.35		11457.23	1286.88	13	864,480	973,864	13
Value of Production	13500.00	-0.03	13162.50	-337.50	-3	1,147,500	1,118,813	(3)
Net Returns	3329.65		1705.27	-1624.38	-49	283,020	144,948	(49)

Based on 85 acre vegetable operation in Dade county.

Source: Scott A. Smith and Timothy G. Taylor, *Production Costs for Selected Vegetables in Florida*, University of Florida Circular 1176, Gainsville, 1997

- **Food consumed away from home**. These foods have an even larger service component, so the energy cost increase impact likely would be smaller. Thus, the impact on $320.3 billion in expenditures could be about 2%, or $6.4 billion.

A key question is the amount of these costs that would be passed on to consumers. Clearly, with the negative impacts of energy cost increases across the economy, consumers would be expected to search for lower cost foods in efforts to reduce expenditures. Still, a major share of the expected increases in marketing and processing costs likely would be passed on to consumers, and could mean a cost increase of $18.0 billion (2.6%) from increased marketing costs alone.

The average US consumer spends 11.9% of disposable income on food, so that a modest increase in expenditures would have only a small impact on level of living. However, 37.4% of US households have less than $20,000 after-tax income, and spend far higher proportions of their income on food – for those with more than $5,000 after-tax income, families spend between 21.2% and 31.7% of their incomes on food. For those with very low incomes (less than $5,000), food expenditures are more than 100% of after-tax income. Thus, for lower income consumers, even a modest 2.6% increase in food expenditures could imply a significant hardship.

Impacts on Food Assistance Programs

One part of the nation's food expenditure is through public programs (Table 24), especially the six food programs operated by USDA.[9] For example, the Food Stamp income supplement program will serve more than 23 million persons in 1998, the Child Nutrition program will serve 26.5 million students, and an additional 7.8 million persons will be served through the Women, Infants and Childrens' nutrition program (WIC, also known as the Special Supplemental Nutrition Program) and related programs. These programs cost about $39.4 billion in FY 1998.

These program costs would be affected by increases in energy costs in two ways – the cost of the food assistance provided would be expected to increase in an effort to hold benefits near current levels, and the number of persons eligible for assistance would increase, as well. While the DRI estimate of employment impacts indicates that the negative effects of the Kyoto Protocol would decline (and disappear by 2020), the initial effects are negative and could be severe – as great as the loss of 1.25 million jobs. And, while it is not clear what the impact of such a large job loss, together with a 1.6% decline in GDP would mean for the Food Stamp and Child Nutrition programs, it could mean an increase in Food Stamp participants of perhaps 40% of the increase in unemployment – 500,000 participants. That would imply a 2.1% increase in program eligibility to 23.9 million participants. The combination of a 2.1% increase in eligibility, plus more costly foods would mean a significant increase in program costs – an increase of perhaps 3%, assuming that the program lags somewhat in providing the full increase in benefit costs. Applying this cost increase to all of the six USDA feeding programs implies a cost increase of $1.2 billion. The full

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[9] There are, of course, other food programs serving public institutions – military, prisons, and many others – that are affected by changes in food costs. However, it is beyond the scope of this study to estimate those costs and impacts.

Table 19. North Central Hog Operation, 1996 Conditions

	Per Cwt Sold					Per Farm		
Cash Expenses/Cwt	*Cost*	*Impact*	*Adj Cost*	*Change*	*Change*	*Cost*	*Adj Cost*	*Change*
Feed	*$/cwt*	*pct*	*$/cwt*	*$/cwt*	*%*	*$*		*%*
Grain	17.86	0.22	21.79	3.93	22	187,530	228,787	22
Protein	11.29	0.14	12.87	1.58	14	118,545	135,141	14
Complete Mixes	5.67	0.2	6.80	1.13	20	59,535	71,442	20
Other Feed Items	0.8	0.2	0.96	0.16	20	8,400	10,080	20
Total Feed Costs	35.62		42.42	6.80	19	374,010	445,450	19
Feeder Pigs	3.58	0.03	3.69	0.11	3	37,590	38,718	3
Veterinary and Meds	1.57	0	1.57	0.00	0	16,485	16,485	—
Bedding and Litter	0.1	0.05	0.11	0.01	5	1,050	1,103	5
Marketing	0.56	0.06	0.59	0.03	6	5,880	6,233	6
Custom Services	0.47	0.03	0.48	0.01	3	4,935	5,083	3
Fuel, Lube, Electricity	1.84	0.29	2.37	0.53	29	19,320	24,923	29
Repairs	1.45	0.03	1.49	0.04	3	15,225	15,682	3
Hired Labor	2.78	0.03	2.86	0.08	3	29,190	30,066	3
Total, Variable Cash	47.97		55.59	7.62	16	503,685	583,741	16
General Overhead	1.72	0.04	1.79	0.07	4	18,060	18,782	4
Taxes and Insurance	1.06	0.05	1.11	0.05	5	11,130	11,687	5
Interest	2.9	-0.02	2.85	-0.05	-1.75	30,450	29,917	(2)
Total Fixed	5.68		5.75	0.07	1	59,640	60,386	1
Total Cash Expenses	53.65		61.35	7.70	14	563,325	644,127	14
Value of Production	53.64	-0.03	52.30	-1.34	-3	563,220	549,140	(3)
Net Returns	-0.01		-9.05	-9.04		(105)	(94,988)	

Based on 200 sow, farrow to finish North Central States Hog operation.

Source: ERS, USDA

Table 20. Upper Midwest Dairy Operation, 1996 Conditions

	Per Cwt Sold					Per Farm		
Cash Expenses/Cwt	***Cost***	***Impact***	***Adj Cost***	***Change***	***Change***	***Cost***	***Adj Cost***	***Change***
Feed	*$/cwt*	*pct*	*$/cwt*	*$/cwt*	*%*	*$*		*%*
Concentrates	4.19	0.19	4.99	0.80	19	88,200	104,957	19
Byproducts	0.11	0.05	0.12	0.01	5	2,316	2,431	5
Liquid Whey	0.16	0.05	0.17	0.01	5	3,368	3,536	5
Hay	1.04	0.1	1.14	0.10	10	21,892	24,081	10
Silage	1.51	0.1	1.66	0.15	10	31,786	34,964	10
Pasture, Forage	0.16	0	0.16	0.00	0	3,368	3,368	—
Total Feed Costs	7.2		8.2	1.06	15	150,929	173,338	15
Hauling	0.25	0.24	0.31	0.06	24	5,263	6,526	24
Art Insemination	0.15	0.05	0.16	0.01	5	3,158	3,315	5
Vet and Medicine	0.43	0.05	0.45	0.02	5	9,052	9,504	5
Bedding, Litter	0.31	0.05	0.33	0.02	5	6,526	6,852	5
Marketing	0.25	0.1	0.28	0.03	10	5,263	5,789	10
Custom Services	0.34	0.03	0.35	0.01	3	7,157	7,372	3
Fuel, Lube, Electricity	0.62	0.29	0.80	0.18	29	13,051	16,836	29
Machinery, Repairs	1.01	0.03	1.04	0.03	3	21,261	21,898	3
Hired Labor	0.56	0	0.56	0.00	0	11,788	11,788	—
DHIA Fees	0.07	0	0.07	0.00	0	1,474	1,474	—
Dairy Assessment	0.03	0	0.03	0.00	0	632	632	—
Total, Variable Cash	11.19		12.60	1.41	13	235,550	265,323	13
General Overhead	0.65	0.04	0.68	0.03	4	13,683	14,230	4
Taxes and Insurance	0.43	0.05	0.45	0.02	5	9,052	9,504	5
Interest	1.16	-0.02	1.14	-0.02	-1.75	24,418	23,991	(2)
Total Fixed	2.24		2.27	0.03	1	47,152	47,725	1
Total Cash Expenses	13.43		14.87	1.44	11	282,702	313,047	11
Value of Production	14.74	-0.03	14.37	-0.37	-2	310,277	302,520	(3)
Net Returns	1.31		-0.50	-1.81	-138	27,576	(10,527)	(138)

Based on 125 cow Upper Midwest Dairy Operations

Source: ERS, USDA

Table 21. Great Plains Cow-Calf Operation, 1996 Conditions

	Per Cow Sold					Per Farm		
Cash Expenses/Cow	*Cost*	*Impact*	*Adj Cost*	*Change*	*Change*	*Cost*	*Adj Cost*	*Change*
	$/cow	*pct*	*$/cow*	*$/cow*	*%*	*$*		*%*
Grain	9.58	0.19	11.40	1.82	19	4,790	5,700	19
Protein Supplements	36.70	0.15	42.21	5.51	15	18,350	21,103	15
Byproducts	7.72	0.05	8.11	0.39	5	3,860	4,053	5
Harvested Forages	98.53	0.1	108.38	9.85	10	49,265	54,192	10
Pasture	79.70	0	79.70	0.00	0	39,850	39,850	---
Total Feed Costs	232.2		249.8	17.56	8	116,115	124,897	8
Feeder Cattle	13.4	0.2	15.42	2.01	15	6,705	7,711	15
Vet and Medicine	17.46	0.05	18.33	0.87	5	8,730	9,167	5
Livestock Hauling	2.99	0.2	3.59	0.60	20	1,495	1,794	20
Marketing	4.46	0.1	4.91	0.45	10	2,230	2,453	10
Custom Feed Mixing	0.29	0.1	0.32	0.03	10	145	160	10
Fuel, Lube, Electricity	24.95	0.29	32.19	7.24	29	12,475	16,093	29
Machinery, Repairs	34.18	0.03	35.21	1.03	3	17,090	17,603	3
Hired Labor	28.87	0.02	29.45	0.58	2	14,435	14,724	2
Other Variable Cash Exp.	6.46	0	6.46	0.00	0	3,230	3,230	—
Total, Variable Cash	365.30		395.66	30.36	8	182,650	197,830	8
General Overhead	35.99	0.04	37.43	1.44	4	17,995	18,715	4
Taxes and Insurance	13.89	0.05	14.58	0.69	5	6,945	7,292	5
Interest	28.65	-0.02	28.15	-0.50	-1.75	14,325	14,074	(2)
Total Fixed	78.53		80.16	1.63	2	39,265	40,081	2
Total Cash Expenses	443.83		475.82	31.99	7	221,915	237,911	7
Value of Production	429.03	-0.03	418.30	-10.73	-3	214,515	209,152	(3)
Net Returns	-14.80		-57.52	-42.72	289	(7,400)	(28,759)	(303)

Based on a 500-animal Great Plains Cow-Calf Operation

Source: ERS, USDA

IV. Food System Impacts

The agricultural production system is fundamentally important to our food and fiber system, but by far the largest share of our foods' value is added after it leaves the farm gate. In fact, the farm value of food products is less than 10% of the retail cost of cereals, for example, and ranges widely across food products to a high of 49% for eggs. For the US Department of Labor's Market Basket of foods, the average farm value was 24.9% of retail cost in 1996.

Just as the on-farm production process is sensitive to increases in energy costs, the activities that transport, store, process and market first commodities and then foods also depend heavily on energy—including electricity and motor fuels, especially. As a result, the energy cost increases associated with emission constraints would be expected to have a significant impact on the more than 75% of food costs that are added after the farm gate, as well as those associated with on-farm production.

US food expenditures were $715 billion in 1997 (exclusive of alcoholic beverages), with 55% of that consumed at home and 45% away from home (Table 23). And, while it is beyond the scope of this study to attempt to estimate specifically how much food expenditures would be increased by the increased energy costs, some comparisons are useful.

Table 23. US Food Expenditures

Food Consumed	*1995*	*1996*	*1997*	*Impact*	
		bil $		*%*	*bil $*
At Home	364.7	380.1	394.7	0.03	11.9
Away From Home	298.3	308.2	320.3	0.02	6.4
Total	663.0	688.3	715.0		18.3
		bil 1996 $			
At Home	373.8	380.1	386.8	0.03	11.7
Away From Home	305.8	308.2	313.9	0.02	6.3
Total	679.6	688.3	700.7	0.026	18.0
		Change (%), 1996 $			
At Home		1.7	1.8		
Away From Home		0.8	1.8		
Total		1.3	1.8		

Note: Food only. Excludes alcoholic beverages.

Source: ERS, USDA

- **Food consumed at home**. Based on market basket statistics, 75.1% of retail cost was added after the farm gate. Applying that share directly to food consumed at home implies that $296.4 billion is marketing cost. A large component of marketing costs is labor cost, so it is likely to be somewhat less sensitive to energy costs than are farm production costs, which could increase 8.8% by 2010. Assuming a 4% increase in marketing costs implies an increase in the cost of food consumed at home of 3%, or $11.9 billion.

increase (unlagged) of 5.1% implied by both increases in food expenditures and increased eligibility would mean an additional $2.0 billion of program costs in 1997 dollars.

Table 24. Food Distribution Programs

USDA Food Programs	*FY 1996*	*FY 1997*	*FY 1998*
	million $		
Food Stamp Program	25,467	24,912	25,841
Child Nutrition Program	8,469	8,713	8,926
Special Supplemental Nutrition Program	3,715	3,975	4,108
Commodity Assistance Program	316	422	372
Food Program Administration	105	104	106
Center for Policy and Promotion	3	2	2
Total	38,075	38,128	39,355
	average participation (mil)		
Food Stamp Program	25.5	24.3	23.4
Child Nutrition Program	25.7	26.2	26.5
Special Supplemental Nutrition Program	7.2	7.4	7.5
Commodity Assistance Program	0.4	0.4	0.3
	benefit (per person/month)		
Food Stamp Program	73.3	73.0	77.3
Special Supplemental Nutrition Program	31.2	32.3	33.2

V. Summary and Conclusions

Limitations to the Study

This study uses as its basis two primary information sources: The DRI/McGraw Hill evaluation of likely economic impacts of carbon emission constraints, and USDA estimates of farm production costs and sales, of food costs and food program expenditures, and of energy use across the farm sector. Nevertheless, it depends heavily on key assumptions and analyst judgment for its conclusions. Key assumptions include:

- **Amounts of energy used by farmers and likely changes in response to price increases**. Data regarding energy use by the sector are sparse and dated (1991 and earlier). Clearly, the sector has changed significantly since that time, and energy use patterns have shifted, as well. Analyst judgment regarding both use levels and likely shifts in response to price changes were used. While these estimates are subject to refinement, they were applied consistently and were intended to reflect actual practices as much as possible.

- **Application of current practices to 2010 conditions**. US agriculture, commodity marketing, food processing and other activities across the sector clearly will shift significantly between the current time and 2010. However, there is little information regarding likely changes in energy use patterns. And, the degree of change will depend significantly on prices, costs and markets. As a result, it was necessary for the purposes of the study to assume that current patterns will be unchanged through 2010.

- **Timing of impacts**. The study focuses on the most recent data and information available, primarily preliminary estimates of 1998 sales and expenses, and to estimate generally potential impacts of emission restraints by 2010. In fact, it still is not known how the programs would be phased in, and some key aspects (e.g., the amount of permissible emissions permit trading between nations) are particularly difficult to estimate. As a result, no specific allowance was included for economic and other adjustments that may take place as the constraints are imposed gradually. While these adjustments are likely, it is beyond the scope of this study to evaluate their likely timing or extent.

- **Technology**. Energy cost increase estimates were based upon DRI/McGraw Hill Case 1 estimates and assume no dramatic technology response from base case conditions. Technology changes are likely, both in carbon emission controls and in agricultural energy use. However, it was beyond the scope of this study to estimate the extent or timing of such increases. Nevertheless, the areas of sharp increases in production cost in agriculture indicate areas where producers and input providers would be expected to focus investment to increase technology.

- **Export sales responses**. Since it was beyond the scope of the study to evaluate the competitive position of all agricultural markets and competing exporters under emission constraints, changes in US exports were assumed. These assumptions are subject to refinement given additional research, but are consistent with past response patterns.

- **Domestic market and food program responses**. These estimates also were based on assumptions and could be refined with additional research.

Economic assumptions are critical to the conclusions of any evaluation of policy change, and clearly this report is no exception. Nevertheless, it does systematically apply economic conclusions of the DRI/McGraw Hill study to agriculture, identify key areas where significant impacts would be expected, and draw conclusions regarding the economic and political consequences of such impacts. Such estimates and conclusions would be expected to be useful in the evaluation of available policy options as the debate on controlling emissions develops in the months and years ahead.

Summary and Conclusions

The preceding analysis describes a set of economic circumstances that could lead to a classic cost-price squeeze for agriculture. Such situations have developed before, with very negative results. The export boom and energy cost increases in the 1970s and the subsequent inflation caused enormous problems two decades ago. For some sectors, for example dairy, feed cost increases outpaced consumer price increases. Thousands of dairy cows were slaughtered as a result, and the sector was many years recovering. Fear of a similar squeeze caused sharp increases in government interventions in the sector in the late 1970s and early 1980s.

Even if energy cost increases this time were imposed slowly over a long period of time, changes as large as those suggested by the DRI analysis would have severe impacts from three directions:

- **Sharp increases in production costs.** The higher raw material costs could add costs of perhaps $16.2 billion (8.8% of production expenses for the sector), increasing the cost of virtually all farming, marketing, storage, processing and transportation operations. However, farmers, unlike some other sectors, would be largely unable to pass these cost increases to consumers in the short run, in part because of the nature of the economic structure (with producers primarily as price-takers), and in part because the same energy price increases weaken consumer demand.

- **Declines in domestic consumer demand.** This would occur especially for high-value products in response to a 1.6% decrease in GDP and a 2.4% decrease in disposable income by 2010, leading to a perhaps 0.7% decline in the demand for food. This effect would weaken consumer prices relative to the base case assuming production and import levels were unchanged in the short run, but would be expected to lead to declines in production and subsequent increases in prices as the sector adjusts over the longer term.

- **Declines in foreign market demand.** This would likely result from increased competition from developing countries who do not face the sharp energy increases that US producers face as they expand production to capture markets currently held by the United States. A major case in point would be fruit and vegetable production along the border with Mexico. If Mexico, for either political or economic reasons, does not face sharp increases in energy costs, its current advantageous position based on climate and abundant energy supplies would be substantially enhanced by the significant increases in US production costs (13% for the Florida tomato example).

The result of this confluence of economic and competitive factors would reduce US farm income very substantially in the short run, nearly 53% in 1997 dollars under the assumptions above. Net cash income for US producers has averaged over $50 billion in recent years. An income cut of 53% would result in an enormous political outcry, and likely lead to a complete restructuring of agricultural policy as a similar (much less threatening) situation did in the late 1970s. Such interventions always have proved costly to taxpayers and tend to endure, often long after the initial adversity has long passed.

Based on the DRI macroeconomic estimates, the Case 1 energy costs (associated with the Protocol) would mean severe impacts for US agriculture. It could mean, by 2010:

- Sharply higher production costs (up $16.2 billion, 8.8%) that it would have very great difficulty passing on to consumers.

- Demand for agricultural products would be reduced significantly, both by the declines in GDP and consumers' disposable income and by the fact that competing producers in developing countries operating without carbon emission constraints would be expected to claim commodity and food markets in third countries and in the United States.

- For each of the "typical farms," the impacts of the energy cost increases was large, and reduced net returns sharply (Table 25).

Table 25. Impacts of Energy Cost Increases on Typical Farms

Farm Type	*Cash Costs*	*Net Returns*
	percent change	
Corn-Soybean Operation	22	-39
Hog Operation	14	turns substantially negative
Dairy Operation	11	-138
Cow-Calf Operation	7	-303
Tomato Operation	13	-49

- Increasing costs of processing, marketing, storing and handling commodities and food products would be expected to widen marketing spreads and boost consumers' food expenditures significantly, further depressing demand at the farm level. Increasing energy costs for processing and marketing could cost consumers perhaps $18 billion, an additional 2.6% of food consumption expenditures in the short run.

- The combination of increased unemployment resulting from increased energy costs and higher food costs could sharply increase the cost of public feeding programs. For example, USDA spends more than $39 billion for six feeding programs, including primarily the Food Stamp and Child Nutrition Programs. For USDA programs alone, emission controls put in place by the Protocol could add 500,000 persons to Food Stamp rolls, and increase program costs up to 5% annually, an annual cost increase of $2.0 billion.

- The impact of the modest increase in food costs would be small for the average US consumer who spends 11.9% of disposable income on food. However, for the 37.4% of US households with less than $20,000 after-tax income, and who spend from 21.2% to more than 100% of after-tax income on food, the impact could be severe and negative.

- The higher energy costs, together with the reduced domestic and export demand could lead to a very severe decline in investment in agriculture, and a sharp increase in farm consolidation. Small farm numbers likely would decline much more rapidly than under baseline conditions, while investment in even larger commercial farms likely would stagnate or decline.

- Policies that sharply increase energy costs in the United States but not in developing countries could make US products much less competitive. As a result, they could lead to sharply higher imports, and boost our negative balance of trade. Developing countries would have increased incentives to produce their own food, for example, and to compete for other developing country markets. This could be significant for agriculture, for a broad range of products including, for example, vegetables and fruits and many others. The result would be greater political pressure against trade agreements, and against free trade policies – including those agreements already in place.

- The impacts of higher energy costs are severe for agriculture (higher costs, declining domestic and export markets), and would almost certainly lead to a return of some form of government intervention in the sector, much as was done in the 1970s and 1980s when similar concerns arose (Table 26).

Table 26. Impacts of Kyoto Protocol on Agriculture and Food System

Item	*Change*	
	billion $	*percent*
Production Costs	16.2	8.8
Market Revenues		
Domestic Sales	-1.4	-0.7
Export Sales	-3.6	-6 to -7
Farm Income	-21.6	-53
Food Costs	18.2	2.6
Food Program Costs	1.5 to 2.1	4.0 to 5.0

VI. APPENDIX

Appendix Table A. US Agricultural Exports by Region

Region/Country	*1995*	*1996*	*1997*	*1998(f)*	*Change From Previous Year* *1995*	*1996*	*1997*	*1998(f)*
		$ million				*(Percent)*		
Western Europe	9,003	9,698	9,540	9,500	22	8	-2	0
European Union 1/	8,646	9,319	8,918	8,800	23	8	-4	-1
Eastern Europe	293	439	282	300	-13	50	-36	6
Former Soviet Union	1,346	1,747	1,483	1,200	35	30	-15	-19
Asia 2/	27,939	28,556	25,624	21,500	37	2	-10	-16
West Asia (Mideast)	2,478	2,513	2,553	2,500	37	1	2	-2
Southeast Asia	3,012	3,270	2,988	2,300	55	9	-9	-23
Japan	10,957	11,702	10,532	10,300	18	7	-10	-2
China	2,633	2,092	1,600	1,600	144	-21	-24	0
Hong Kong	1,488	1,490	1,712	1,700	21	0	15	-1
Taiwan	2,597	2,964	2,616	2,400	21	14	-12	-8
Korea, Rep.	3,751	3,871	2,857	2,400	61	3	-26	-16
Africa	3,070	2,876	2,267	2,300	23	-6	-21	1
North Africa	2,144	1,986	1,559	1,500	25	-7	-22	-4
Sub-Sahara	925	891	707	800	20	-4	-21	13
Latin America & Caribbean	7,926	10,481	10,363	10,800	-1	32	-1	4
Mexico	3,519	5,446	5,184	5,800	-22	55	-5	12
Canada	5,738	6,145	6,795	6,900	4	7	11	2
Oceania	499	488	550	600	-8	-2	13	9
TOTAL	55,814	60,431	57,245	56,000	22	8	-5	-2
Developed Countries	26,908	28,884	28,431	28,200	16	7	-2	-1
Developing Countries	24,899	27,674	25,687	24,900	22	11	-7	-3
Other Countries	4,007	3,873	3,128	2,900	91	-3	-19	-7

(f) = forecast

1/ Austria, Finland, and Sweden are included in the European Union.

2/ Asia forecast excludes West Asia (Mideast).

Source: USDA

The Kyoto Protocol:

An Assault on an American Institution

Potential Impacts on U.S. Agriculture

Co-Sponsored by:

American Farm Bureau
American Corn Growers Assn.
National Cattlemen's Beef Assn.
United Fruit & Vegetable Assn.
National Grange

The Kyoto Protocol

An Assault on an American Institution

The family farm is an American institution. More than any other industry, U.S. agriculture defines us as a people and as a Nation. In the past, American farmers have coped with drought and disease, falling prices, and shrinking profits. Now, the family farm faces a new threat – the Kyoto Protocol – that will bring unexpected hardship to many should it be enacted as official U.S. policy.

From the wheat farmers on the Great Plains to fruit and vegetable producers in California, Florida, and across the South, America's farmers produce the bounty that feeds the U.S. and the world.

Not only does agriculture play a key role in feeding the people of the world, it contributes significantly to the U.S. economy. Agriculture and related food distribution account for nearly $1 trillion in total sales or 13 percent of the total U.S. gross domestic product (GDP). Agriculture in the U.S. is a vital domestic industry, providing jobs to 23 million American workers or 17% of the total labor force. Exports of agricultural products also help to balance our trade with other nations, with nearly $54 billion in total sales abroad.

Recent technological investments have made the U.S. agriculture industry the most advanced in the world. However, farming remains an energy intensive industry. Diesel, gasoline, electricity, and other forms of energy are required to produce the crops and livestock that feed the world. As a result, the agricultural sector is extremely vulnerable to changes in energy costs.

In addition, U.S. agriculture has invested heavily to insure that it is competitive in foreign markets – the single most important area of growth for U.S. farms. Not only has the industry cut costs to compete, but the federal government has realigned policies to end price supports and other interventions that reduce competitiveness. Consequently, in 1998, agricultural exports could reach nearly $54 billion and contribute more than $18 billion to our balance of trade. If the Kyoto Protocol is implemented, U.S. agricultural exports could be reduced by $3.6 billion – a loss in the range of 6-7% of total exports.

The Kyoto Protocol

In December 1997, over 180 nations met in Kyoto, Japan, to finalize negotiations on a legally binding international treaty aimed at lowering greenhouse gas emissions. The new treaty – called the UN Kyoto Protocol – requires a handful of nations, including the United States, to reduce their greenhouse gas emissions to specific levels by the years 2008-2012. While each country accepted a different level of emission reductions, on average the agreement seeks to reduce total world greenhouse gas emissions to 5% below 1990 levels during this period.

For its part, the United States agreed to reduce its emissions to 7% below 1990 levels by this timeframe. Additional emission reductions will be required in the second budget period (2013-2018), and the level of reductions required in that timeframe will be the subject of future international negotiations.

Key aspects of the Protocol include:

- The agreement covers six gases (CO_2, methane, nitrous oxide, HFCs, PFCs, and SF_6).
- Countries with emerging economies such as China, India, Mexico, and South Korea, exempted themselves from the Protocol.
- The definition of sinks (objects that clean, or remove emissions, from the atmosphere) was limited to include only forestry activities. Agricultural crops and other vegetation are not considered sinks by the Kyoto Protocol.
- Enforcement measures of the Protocol by the United Nations were left undefined and will be the subject of future international negotiations.

Economic Costs of Kyoto

In defending the Kyoto Protocol, the Administration claims this change in national energy policy will not adversely impact the agriculture industry. In contrast, several studies conducted by leading economic forecasting firms and the Energy Information Administration (the federal government's own energy forecasting agency) provide starkly different predictions. Using analysis developed by Standard & Poor's Data Resource International (DRI), this study shows that implementation of the Kyoto Protocol will mean, by 2010:

- **Fewer small, family farms.** Higher energy costs, together with the reduced domestic and export demand could lead to a severe decline in agricultural investment, and a sharp increase in farm consolidations. The number of small farms likely would decline much more rapidly than under business-as-usual conditions.
- **Higher production costs**. Production costs could increase by up to $16.2 billion (8.8%) and would be difficult for agriculture to pass on to consumers. These higher production costs include a $13 billion increase in manufactured input (fuel, fertilizer, and chemicals) expenditures, a $1.6 billion increase in farm origin (feed, livestock, and seed) inputs, and a $1.9 billion increase in general operating expenses.

- **Lower demand for agricultural products.** Weaker demand for agricultural products results both from the 1.6% decline in GDP and 2.4% decrease in consumers' disposable income. U.S. farmers would be forced to compete with producers in developing countries who do not face emission constraints. These changes could reduce sales by $5 billion at the farm level.

- **Reduced farm income.** As a result of reduced agricultural revenues and increased production costs, net farm income could be reduced $21.5 billion from 1998 levels to $24 billion – more than a 50% decline.

- **Increased marketing costs.** Costs of processing, storing, transporting and handling commodities and food products would increase. The wider marketing spreads could boost consumers' food expenditures nearly $18 billion.

- **Higher food costs.** The increase in food marketing costs would be small for the average U.S. consumer who spends 11.9% of disposable income on food. However, 37% of U.S. households have less than $20,000 in after-tax income and spend from 21.2% to more than 100% of their after-tax income on food. In these families, infants and children would experience the greatest impact to their diets.

- **Higher food program costs.** For example, USDA spends more than $39 billion for six food assistance programs, including the Food Stamp and Child Nutrition Programs. For these programs alone, emission controls from the Protocol could add 500,000 persons to Food Stamp rolls and increase program costs up to 5% annually.

Conclusion

The Kyoto Protocol is a flawed treaty that will have a dramatically negative impact on the U.S. agriculture industry. The family farm, an American institution, will be put at risk for a treaty that exempts other competitor nations from the same types of energy restrictions and higher costs that American farmers will be forced to endure.

For More Information

American Farm Bureau Federation
(202) 484-3600

American Corn Growers Association
(202) 452-9422

National Cattlemen's Beef Association
(202) 347-0228

National Grange
(202) 628-3507

United Fresh Fruit & Vegetable Association
(703) 836-3410

◆

JAMES M. TALENT, MISSOURI
CHAIRMAN

NYDIA M. VELÁZQUEZ, NEW YORK

Congress of the United States
House of Representatives
106th Congress
Committee on Small Business
2361 Rayburn House Office Building
Washington, DC 20515-0515

May 24, 1999

Honorable Janet L. Yellen
Chair
Council of Economic Advisors
OEOB
17th & Pennsylvania Ave., N.W.
Washington, D.C. 20500

Dear Dr. Yellen:

Thank you for testifying at the Committee's hearing on the Kyoto Protocol. I appreciate your willingness to explain the Administration's Economic Analysis published after the Committee's June 4, 1998 hearing.

Enclosed please find a copy of your testimony and a standard edit letter. Please review the edit letter and your testimony and make any necessary grammatical, punctuation, and/or spelling corrections. Substantive additions or deletions to the actual testimony are not permitted. I would appreciate receiving your corrections by June 11, 1999.

Likewise, enclosed please find follow-up questions from Committee members in attendance at the hearing. I am forwarding these questions with your testimony as they attempt to clarify your responses to questions posed to you and request materials identified in your testimony. In order to timely publish and complete the hearing transcript, I would also appreciate receiving your responses to these questions and all documents requested by June 18, 1999.

Thank you for your attention to this matter. If you have any questions, please do not hesitate to contact Roger Keller or Paul Denham of the Committee staff at (202) 225-5821.

Sincerely,

James M. Talent
Chairman

Questions for the record and requests for documents by Chairman James M. Talent for Dr. Janet L. Yellen, Chair, Council of Economic Advisors

1. Is the July 1998 "Kyoto Protocol and the President's Policies to Address Climate Change: Administration Economic Analysis" the only analysis, economic or otherwise, published by the Administration with regard the Kyoto Protocol's economic effects?

   a. Please provide the anticipated amount of greenhouse gas emissions and reduction obligations as published in the Administration's July 1998 analysis for each country from 2008 to 2012 identified in attached **Chart A**.

   b. Please provide the anticipated amount of credits the Administration's July 1998 published analysis assumes each country from 2008 to 2012 identified in **Chart B** will supply or demand.

   c. Complete the anticipated domestic baseline costs, e.g., without any flexibility measures, the Administration's July 1998 analysis assumes will be necessary for each country from 2008 to 2012 identified in **Chart C** to meet its Kyoto Protocol obligations.

2. If your response to question 1 is negative, identify and produce any additional analysis, economic or otherwise, published by the Administration. If any additional analyses are produced, provide the same information for each analysis as requested in question 1.

3. Has the Administration published an analysis, economic or otherwise, that demonstrates the Kyoto Protocol's effects on U.S. jobs?

4. If your response to question 3 is yes, identify and produce all analysis, economic or otherwise, published by the Administration.

5. Identify and produce all Administration documents used to prepare the United States delegates to the Conference of the Parties (COP-3) in Kyoto, Japan in December 1997.

   a. Please identify and produce any quantitative economic analysis the Administration made before the Kyoto Protocol that analyzes the Protocol's effect on the United States' economy.

6. Identify and produce all Administration analyses after December 10, 1997 that analyzes, either economically or otherwise, the obligations assumed by the United States at the Conference of the Parties (COP-3) in Kyoto, Japan in December 1997.

a. Complete the anticipated amount of greenhouse gas emissions and reduction obligation each analysis identified in your response to question no. 6 assumes for each country from 2008 to 2012 listed in attached **Chart A**.

b. Complete the anticipated amount of credits each analysis identified in your response to question no. 6 assumes each country from 2008 to 2012 identified in **Chart B** will supply or demand.

c. Complete the anticipated domestic baseline costs, e.g., without any flexibility measures, each analysis identified in your response to question no. 6 assumes will be necessary for each country from 2008 to 2012 identified in **Chart C** to meet its Kyoto Protocol obligations.

7. Identify and produce all Administration analyses, either economic or otherwise, prior to December 10, 1997 that demonstrates the effect on the U.S. economy of reducing greenhouse gas emissions to 1990 levels.

a. Complete the anticipated amount of greenhouse gas emissions and reduction obligation each analysis identified in your response to question no. 7 assumes for each country from 2008 to 2012 identified in attached **Chart A**.

b. Complete the anticipated amount of credits each analysis identified in your response to question no. 7 assumes each country from 2008 to 2012 identified in **Chart B** will supply or demand.

c. Complete the anticipated domestic baseline costs, e.g., without any flexibility measures, each analysis identified in your response to question no. 7 assumes will be necessary for each country from 2008 to 2012 identified in **Chart C** to meet its Kyoto Protocol obligations.

8. Identify and produce all Administration analyses, either economic or otherwise, after December 10, 1997 that demonstrates the effect on the U.S. economy of reducing greenhouse gas emissions to 1990 levels.

a. Complete the anticipated amount of greenhouse gas emissions and reduction obligation each analysis identified in your response to question no. 8 assumes for each country from 2008 to 2012 identified in attached **Chart A**.

b. Complete the anticipated amount of credits each analysis identified in your response to question no. 8 assumes each country from 2008 to 2012 identified in **Chart B** will supply or demand.

c. Complete the anticipated domestic baseline costs, e.g., without any flexibility measures, each analysis identified in your response to question no. 8 assumes will be necessary for each country from 2008 to 2012 identified in **Chart C** to meet its Kyoto Protocol obligations.

9. Identify and produce all Administration analyses, either economic or otherwise, prior to December 10, 1997 that demonstrates the effect on the U.S. economy of reducing greenhouse gas emissions to 7% below 1990 levels.

a. Complete the anticipated amount of greenhouse gas emissions and reduction obligation each analysis identified in your response to question no. 9 assumes for each country from 2008 to 2012 identified in **Chart A**.

b. Complete the anticipated amount of credits each analysis identified in your response to question no. 9 assumes each country from 2008 to 2012 identified in **Chart B** will supply or demand.

c. Complete the anticipated domestic baseline costs, e.g., without any flexibility measures, each analysis identified in your response to question no. 9 assumes will be necessary for each country from 2008 to 2012 identified in **Chart C** to meet its Kyoto Protocol obligations.

10. Identify and produce all Administration analyses, either economic or otherwise, after December 10, 1997 that demonstrates the effect on the U.S. economy of reducing greenhouse gas emissions to 7% below 1990 levels.

a. Complete the anticipated amount of greenhouse gas emissions and reduction obligation each analysis identified in your response to question no. 10 assumes for each country from 2008 to 2012 identified in **Chart A**.

b. Complete the anticipated amount of credits each analysis identified in your response to question no. 10 assumes each country from 2008 to 2012 identified in **Chart B** will supply or demand.

c. Complete the anticipated domestic baseline costs, e.g., without any flexibility measures, each analysis identified in your response to question no. 10 assumes will be necessary for each country from 2008 to 2012 identified in **Chart C** to meet its Kyoto Protocol obligations.

11. Identify and produce all Administration analyses, either economic or otherwise, prior to December 10, 1997 that demonstrate the effect on the U.S. economy of reducing greenhouse gas emissions any amount.

a. Complete the anticipated amount of greenhouse gas emissions and reduction obligation each analysis identified in your response to question no. 11 assumes for each country from 2008 to 2012 identified in **Chart A**.

b. Complete the anticipated amount of credits each analysis identified in your response to question no. 11 assumes each country from 2008 to 2012 identified in **Chart B** will supply or demand.

c. Complete the anticipated domestic baseline costs, e.g., without any flexibility measures, each analysis identified in your response to question no. 11 assumes will be necessary for each country from 2008 to 2012 identified in **Chart C** to meet its Kyoto Protocol obligations.

12. Identify and produce all Administration analyses, either economic or otherwise, after December 10, 1997 that demonstrate the effect on the U.S. economy of reducing greenhouse gas emissions in any amount.

a. Complete the anticipated amount of greenhouse gas emissions and reduction obligation each analysis identified in your response to question no. 12 assumes for each country from 2008 to 2012 identified in **Chart A**.

b. Complete the anticipated amount of credits each analysis identified in your response to question no. 12 assumes each country from 2008 to 2012 identified in **Chart B** will supply or demand.

c. Complete the anticipated domestic baseline costs, e.g., without any flexibility measures, each analysis identified in your response to question no. 12 assumes will be necessary for each country from 2008 to 2012 identified in **Chart C** to meet its Kyoto Protocol obligations.

13. Identify and produce all Administration analyses, either economic or otherwise, prior to December 10, 1997 that demonstrate the effect on U.S. jobs of reducing greenhouse gas emissions to 1990 levels.

14. Identify and produce all Administration analyses, either economic or otherwise, after December 10, 1997 that demonstrates the effect on U.S. jobs of reducing greenhouse gas emissions to 1990 levels.

15. Identify and produce all Administration analyses, either economic or otherwise, prior to December 10, 1997 that demonstrates the effect on U.S. jobs of reducing greenhouse gas emissions to 7% below 1990 levels.

16. Identify and produce all Administration analyses, either economic or otherwise, after December 10, 1997 that demonstrates the effect on U.S. jobs of reducing greenhouse gas emissions to 7% below 1990 levels.

17. Identify and produce all Administration analyses, either economic or otherwise, prior to December 10, 1997 that demonstrates the effect on U.S. jobs of reducing greenhouse gases any amount.

18. Identify and produce all Administration analyses, either economic or otherwise, after December 10, 1997 that demonstrates the effect on U.S. jobs of reducing greenhouse gases any amount.

19. Complete the anticipated amount of greenhouse gas emissions and reduction obligation the Kyoto Protocol assumes for each country from 2008 to 2012 identified in **Chart A**.

  a. Complete the anticipated amount of credits the Kyoto Protocol assumes each country from 2008 to 2012 identified in **Chart B** will supply or demand.

  b. Complete the anticipated domestic baseline costs, e.g., without any flexibility measures, the Kyoto Protocol assumes will be necessary for each country from 2008 to 2012 identified in **Chart C** to meet its Kyoto Protocol obligations.

20. At the April 29, 1999 hearing, you testified some analyses conclude that the permit price for a ton of carbon dioxide will be less than $14 to $23 per ton. Identify, by author, date of analysis, location of analysis, and produce all analyses which conclude that the permit price for a ton of carbon dioxide is less than the Administration's $14 to $23 per ton.

21. At the April 29, 1999 hearing, you testified some analyses conclude that the permit price for a ton of carbon dioxide will be more than $14 to $23 per ton. Identify, by author, date of analysis and location of the analysis, and produce all analyses which conclude the permit price for a ton of carbon dioxide is more than the Administration's $14 to $23 per ton.

22. Please produce all documents reviewed when responding to these questions.

23. The Administration identified the recent energy restructuring bill's effect on various groups and sectors of the nation. Please provide the same information for the Kyoto Protocol, including, but not limited to, the following:

  a. the Council of Economic Advisors estimates regarding increased costs for an average household in key regions of the country. This should include estimates for oil (heating and gasoline), natural gas, and electricity for a typical household in the Northeast, Southeast, South, Mid-West, Northwest and Southwest regions of the United States;

b. the Council of Economic Advisors estimates regarding increased 2010 living costs for a senior citizen living on social security;

c. the Council of Economic Advisors estimates regarding increased 2010 living costs for an individual living on welfare;

d. the Council of Economic Advisors estimates regarding operating costs for an average small business of 50 employees. This should includes estimates for oil (heating and gasoline), natural gas, and electricity for a typical small business in the Northeast, Southeast, South, Mid-West, Northwest and Southwest regions of the United States.

CHART A

Country	Anticipated Emissions	Reduction Obligation
Australia		
Austria		
Belgium		
Bulgaria		
Canada		
Croatia		
Czech Republic		
Denmark		
Estonia		
Finland		
France		
Germany		
Greece		
Hungary		
Iceland		
Ireland		
Italy		
Japan		
Latvia		
Liechtenstein		
Lithuania		
Luxembourg		
Monaco		
Netherlands		
New Zealand		
Norway		
Poland		
Portugal		
Romania		
Russian Federation		
Slovakia		
Slovenia		
Spain		
Sweden		
Switzerland		
Ukraine		
United Kingdom		
United States		
China		
India		
Mexico		
South Korea		

Chart B

Country	Credits Supplied	Credits Demanded
Australia		
Austria		
Belgium		
Bulgaria		
Canada		
Croatia		
Czech Republic		
Denmark		
Estonia		
Finland		
France		
Germany		
Greece		
Hungary		
Iceland		
Ireland		
Italy		
Japan		
Latvia		
Liechtenstein		
Lithuania		
Luxembourg		
Monaco		
Netherlands		
New Zealand		
Norway		
Poland		
Portugal		
Romania		
Russian Federation		
Slovakia		
Slovenia		
Spain		
Sweden		
Switzerland		
Ukraine		
United Kingdom		
United States		
China		
India		
Mexico		
South Korea		

Chart C

Country	Domestic Cost	Kyoto Obligation
Australia		
Austria		
Belgium		
Bulgaria		
Canada		
Croatia		
Czech Republic		
Denmark		
Estonia		
Finland		
France		
Germany		
Greece		
Hungary		
Iceland		
Ireland		
Italy		
Japan		
Latvia		
Liechtenstein		
Lithuania		
Luxembourg		
Monaco		
Netherlands		
New Zealand		
Norway		
Poland		
Portugal		
Romania		
Russian Federation		
Slovakia		
Slovenia		
Spain		
Sweden		
Switzerland		
Ukraine		
United Kingdom		
United States		
China		
India		
Mexico		
South Korea		

EXECUTIVE OFFICE OF THE PRESIDENT
COUNCIL OF ECONOMIC ADVISERS
WASHINGTON, D.C. 20500

CHIEF OF STAFF

July 12, 1999

Dear Mr. Keller:

Enclosed, via fax, are the responses to questions posed by Chairman Talent and the Members of the Committee on Small Business following testimony by Dr. Janet Yellen on June 4, 1999. The original Qs and As, along with some attachments referred to in our responses, will be delivered to your office tomorrow morning.

On behalf of our Chair, I want to thank you for your assistance in coordinating this project. We would also like to thank Chairman Talent and the Committee Members for their patience and understanding in what has been a very involved process.

Sincerely,

Audrey Choi

Mr. Roger Keller
Counsel
Committee on Small Business
U.S. House of Representatives
Room 2361, Rayburn House Office Building
Washington, D.C. 20515

Enclosure

Questions for the record and requests for documents by Chairman James M. Talent For Dr. Janet L. Yellen, Chair, Council of Economic Advisers

1. Is the July 1998 "Kyoto Protocol and the President's Policies to Address Climate Change: Administration Economic Analysis" the only analysis, economic or otherwise, published by the Administration with regard to Kyoto Protocol's economic efforts?

A1. The July 1998 report "Kyoto Protocol and the President's Policies to Address Climate Change: Administration Economic Analysis" (hereafter "AEA") and the Department of Agriculture's agricultural sector report "Economic Analysis of U.S. Agriculture and the Kyoto Protocol" published earlier this year are the only Administration economic analyses of the Kyoto Protocol of which we are aware.

a. Please provide the anticipated amount of greenhouse gas emissions and reduction obligations as published in the Administration's July 1998 analysis for each country from 2008 to 2012 as defined in attached **Chart A.**

A1a. In conducting the illustrative modeling analysis presented in AEA, the Administration estimated the anticipated emissions reductions necessary to comply with Kyoto Annex B targets for 7 countries and regions within Annex I: United States, Japan, Canada, Australia, Western Europe, Eastern Europe, and Former Soviet Union. This set of countries and regions is consistent with the country aggregations within the Second Generation Model used for this analysis. For a description of the Second Generation Model, please refer to pages 131-156, 182-245 of "The Kyoto Protocol and its Economic Implications", Hearing before the Subcommittee on Energy and Power of the Committee on Commerce, House of Representatives, March 4, 1998 (hereafter "3/98 Energy and Power Hearing"). For these estimates of emissions reductions, please refer to pages 326 and 335 of the 3/98 Energy and Power Hearing. For a description of the derivation of these estimates, please refer to pages 316-321, 334.

b. Please provide the anticipated amount of credits the Administration's July 1998 published analysis assumes each country from 2008 to 2012 identified in **Chart B** will supply or demand.

A1b. The AEA illustrative modeling analysis is not premised on an assumption of how many emissions allowances a country or region would supply or demand. Rather, the analysis made use of supply curves derived from a large set of SGM model runs (please refer to pages 44-46 of the AEA for a description of the construction of abatement cost curves, i.e., supply curves). These supply curves have been published in the 3/98 Energy and Power Hearing, pages 327-331.

Please note that these supply curves are in 1992 U.S. dollars, and the Administration adjusted these to 1997 U.S. dollars for presentation in the AEA.

For the United States, the number of emissions allowances purchased or demanded on an annual average basis during the 2008-2012 commitment period is provided on pages 322-323 of the 3/98 Energy and Power Hearing. Since the number of emissions allowances demanded is a function of the permit price, the spreadsheets on these pages provide a range of emissions purchased abroad that varies with the extent of the trading system.

For the AEA, the Administration did not specifically estimate the number of emissions allowances supplied or demanded by other countries and regions. However, the supply, and implicit demand, for emissions allowances are embedded in the supply curves described above. At a given permit price, the number of domestic emissions reductions for a specific country or region can be estimated, and when compared to the required emissions cut noted on p. 335 of the 3/98 Energy and Power Hearing, it can be estimated whether the country or region is a net supplier or purchaser of emissions allowances.

c. Complete the anticipated domestic baseline costs, e.g., without any flexibility measures, the Administration's July 1998 analysis assumes will be necessary for each country from 2008 to 2012 identified in **Chart C** to meet its Kyoto Protocol obligations.

A1c. In conducting the AEA, the Administration focused on the direct resource costs to the U.S. economy. The results for a wide variety of scenarios, including the scenario where no flexibility mechanisms are used, are provided on pages 322-323 of the 3/98 Energy and Power Hearing. The Administration did not estimate the economic costs to other countries and regions for the AEA.

2. If your response to questions 1 is negative, identify and produce any additional analysis, economic or otherwise, published by the Administration. If any additional analyses are produced, provide the same information for each analysis as requested in question 1.

A2. While we can only answer for the CEA, our understanding is that the Department of Agriculture's analysis did not independently evaluate international emissions trading and the nature of the supply of emissions reductions from all Annex B countries. Thus, the information requested in 1a, 1b, and 1c are not available from this analysis. For an electronic version of this report, we suggest that you download the file from http://www.usda.gov/oce/gcpo/gcponews.htm. We have also enclosed a paper copy for your review.

3. Has the Administration published an analysis, economic or otherwise, that demonstrates the Kyoto Protocol's effects on U.S. jobs?

A3. The AEA includes a discussion of the possible impacts of the Kyoto Protocol on employment. Please refer to page 62 of the AEA for this discussion.

4. If your response to question 3 is yes, identify and produce all analysis, economic or otherwise, published by the Administration.

A4. A copy of the AEA (electronic and paper) was submitted with the April 29 written statement.

5. Identify and produce all Administration documents used to prepare the United States delegates to the Conference of the Parties (COP-3) in Kyoto, Japan in December 1997.

A5. A set of documents pertaining to this request is being provided to the Committee. Additional documents responsive to this request reflect internal deliberations of the Executive Office of the President with regard to ongoing policies of the Administration and have not been produced.

a. Please identify and produce any quantitative economic analysis the Administration made before the Kyoto Protocol that analyzes the Protocol's effect on the United States' economy.

A5a. A set of documents pertaining to this request is being provided to the Committee. Additional documents responsive to this request reflect internal deliberations of the Executive Office of the President with regard to ongoing policies of the Administration and have not been produced.

6. Identify and produce all Administration analyses after December 10, 1997 that analyzes, either economically or otherwise, the obligations assumed by the United States at the Conference of the Parties (COP-3) in Kyoto, Japan in December 1997.

A6. A copy of the AEA (electronic and paper) was submitted with the April 29 written statement. Further, a set of documents pertaining to this request is being provided to the Committee. Additional documents responsive to this request reflect internal deliberations of the Executive Office of the President with regard to ongoing policies of the Administration and have not been produced.

a. Complete the anticipated amount of greenhouse gas emissions and reduction obligation each analysis identified in your response to question no. 6 assumes for each country from 2008 to 2012 listed in attached **Chart A**.

A6a. Regarding the AEA, please refer to the response to question 1. All subsequent CEA analyses make use of the model and assumptions underlying the AEA.

b. Complete the anticipated amount of credits each analysis identified in your response to question no. 6 assumes each country from 2008 to 2012 identified in **Chart B** will supply or demand.

A6b. Regarding the AEA, please refer to the response to question 1. All subsequent CEA analyses make use of the model and assumptions underlying the AEA.

c. Complete the anticipated domestic baseline costs, e.g., without any flexibility measures, each analysis identified in your response to question no. 6 assumes will be necessary for each country from 2008 to 2012 identified in **Chart C** to meet its Kyoto Protocol obligations.

A6c. Regarding the AEA, please refer to the response to question 1. All subsequent CEA analyses make use of the model and assumptions underlying the AEA.

7. Identify and produce all Administration analyses, either economic or otherwise, prior to December 10, 1997 that demonstrates the effect on the U.S. economy of reducing greenhouse gas emissions to 1990 levels.

A7. A set of documents pertaining to this request is being provided to the Committee. Additional documents responsive to this request reflect internal deliberations of the Executive Office of the President with regard to ongoing policies of the Administration and have not been produced.

a. Complete the anticipated amount of greenhouse gas emissions and reduction obligation each analysis identified in your response to question no. 7 assumes for each country from 2008 to 2012 identified in attached **Chart A**.

A7a. The set of economic and other kinds of analyses undertaken by the Administration predating the 1997 Kyoto Conference is large. CEA does not have detailed country-by-country data used in these analyses, most of which were completed by other Administration agencies.

b. Complete the anticipated amount of credits each analysis identified in your response to question no. 7 assumes each country from 2008 to 2012 identified in **Chart B** will supply or demand.

A7b. The set of economic and other kinds of analyses undertaken by the Administration predating the 1997 Kyoto Conference is large. CEA does not have detailed country-by-country data used in these analyses, most of which were completed by other Administration agencies.

c. Complete anticipated domestic baseline costs, e.g., without any flexibility measures, each analysis identified in your response to question no. 7 assumes will be necessary for each country from 2008 to 2012 identified in **Chart C** to meet its Kyoto Protocol obligations.

A7c. The set of economic and other kinds of analyses undertaken by the Administration predating the 1997 Kyoto Conference is large. CEA does not have detailed country-by-country data used in these analyses, most of which were completed by other Administration agencies.

8. Identify and produce all Administration analyses, either economic or otherwise, after December 10, 1997 that demonstrates the effect on the U.S. economy of reducing greenhouse gas emissions to 1990 levels.

A8. We are not familiar with any Administration economic analyses that evaluated an emissions target of 1990 levels after December 10, 1997, with one exception in the set of scenarios evaluated in conducting the AEA. Please refer to page 323 of the 3/98 Energy and Power Hearing for this one scenario. The underlying model and assumptions of this scenario are the same as for the AEA, excluding the U.S. emissions target, which was set at 1990 levels. Please note that the 1990 levels target was evaluated for a domestic only (no international emissions trading) scenario, so the following questions are not applicable.

a. Complete the anticipated amount of greenhouse gas emissions and reduction obligation each analysis identified in your response to question no. 8 assumes for each country from 2008 to 2012 identified in attached **Chart A**.

A8a. Not applicable.

b. Complete the anticipated amount of credits each analysis identified in your response to question no. 8 assumes each country from 2008 to 2012 identified in **Chart B** will supply or demand.

A8b. Not applicable.

c. Complete the anticipated baseline costs, e.g., without any flexibility measures, each analysis identified in your response to question no. 9 assumes will be necessary for each country from 2008 to 2012 identified in **Chart C** to meet its Kyoto Protocol obligations.

A8c. Not applicable.

9. Identify and produce all Administration analyses, either economic or otherwise, after December 10, 1997 that demonstrates the effect on the U.S. economy of reducing greenhouse gas emissions to 7% below 1990 levels.

A9. A copy of the AEA (electronic and paper) was submitted with the April 29 written statement. Further, a set of documents pertaining to this request is being provided to the Committee. Additional documents responsive to this request reflect internal deliberations of the Executive Office of the President with regard to ongoing policies of the Administration and have not been produced.

a. Complete the anticipated amount of greenhouse gas emissions and reduction obligation each analysis identified in your response to question no. 9 assumes for each country from 2008 to 2012 identified in **Chart A**.

A9a. Please refer to the response to question 1a.

b. Complete the anticipated amount of credits each analysis identified in your response to question no 9 assumes each country from 2008 to 2012 identified in **Chart B** will supply or demand.

A9b. Please refer to the response to question 1b.

c. Complete the anticipated domestic baseline costs, e.g., without any flexibility measures, each analysis identified in your response to question no. 9 assumes will be necessary for each country from 2008 to 2012 identified in **Chart C** to meet its Kyoto Protocol obligations.

A9c. Please refer to the response to question 1c.

10. Identify and produce all Administration analyses, either economic or otherwise, after December 10, 1997 that demonstrate the effect on the U.S. economy reducing greenhouse gas emissions to 7% below 1990 levels.

A10. A copy of the AEA (electronic and paper) was submitted with the April 29 written statement. Further, a set of documents pertaining to this request is being provided to the Committee. Additional documents responsive to this request reflect internal deliberations of the Executive Office of the President with regard to ongoing policies of the Administration and have not been produced.

a. Complete the anticipated amount of greenhouse gas emissions and reduction obligation each analysis identified in your response to question no. 10 assumes for each country from 2008 to 2012 identified in **Chart A**.

A10a. Regarding the AEA, please refer to the response to question 1a. All subsequent CEA analyses make use of the model and assumptions underlying the AEA.

b. Complete the anticipated amount of credits each analysis identified in your response to question no. 10 assumes each country from 2008 to 2012 identified in **Chart B** will supply or demand.

A10b. Regarding the AEA, please refer to the response to question 1b. All subsequent CEA analyses make use of the model and assumptions underlying the AEA.

c. Complete the anticipated domestic baseline costs, e.g., without any flexibility measures, each analysis identified in your response to question no. 10 assumes will be necessary for each country from 2008 to 2012 identified in **Chart C** to meet its Kyoto Protocol obligations.

A10c. Regarding the AEA, please refer to the response to question 1c. All subsequent CEA analyses make use of the model and assumptions underlying the AEA.

11. Identify and produce all Administration analyses, either economic or otherwise, prior to December 10, 1997 that demonstrate the effect on the U.S. economy of reducing greenhouse gas emissions any amount.

A11. A set of documents pertaining to this request is being provided to the Committee. Additional documents responsive to this request reflect internal deliberations of the Executive Office of the President with regard to ongoing policies of the Administration and have not been produced.

a. Complete the anticipated amount of greenhouse gas emissions and reduction obligation each analysis identified in your response to question no.11 assumes for each country from 2008 to 2012 identified in **Chart A**.

A11a. The set of economic and other kinds of analyses undertaken by the Administration predating the 1997 Kyoto Conference is large. CEA does not have detailed country-by-country data used in these analyses, most of which were completed by other Administration agencies.

b. Complete the anticipated amount of credits each analysis identified in your response to question no. 11 assumes each country from 2008 to 2012 identified in **Chart B** will supply or demand.

A11b. The set of economic and other kinds of analyses undertaken by the Administration predating the 1997 Kyoto Conference is large. CEA does not have detailed country-by-country data used in these analyses, most of which were completed by other Administration agencies.

c. Complete the anticipated domestic baseline costs, e.g., without any flexibility measures, each analysis identified in your response to question no. 11 assumes will be necessary for each country from 2008 to 2012 identified in **Chart C** to meet its Kyoto Protocol obligations.

A11c. The set of economic and other kinds of analyses undertaken by the Administration predating the 1997 Kyoto Conference is large. CEA does not have detailed country-by-country data used in these analyses, most of which were completed by other Administration agencies.

12. Identify and produce all Administration analyses, either economic or otherwise prior to December 10, 1997 that demonstrate the effect on the U.S economy of reducing greenhouse gas emissions in any amount.

A12. A set of documents pertaining to this request is being provided to the Committee. Additional documents responsive to this request reflect internal deliberations of the Executive Office of the President with regard to ongoing policies of the Administration and have not been produced.

a. Complete the anticipated amount of greenhouse gas emissions and reduction obligation each analysis identified in your response to question no.12 assumes for each country from 2008 to 2012 identified in **Chart A**.

A12a. The set of economic and other kinds of analyses undertaken by the Administration predating the 1997 Kyoto Conference is large. CEA does not have detailed country-by-country data used in these analyses, most of which were completed by other Administration agencies.

b. Complete the anticipated amount of credits each analysis identified in your response to question no. 12 assumes each country from 2008 to 2012 identified in **Chart B** will supply or demand.

A12b. The set of economic and other kinds of analyses undertaken by the Administration predating the 1997 Kyoto Conference is large. CEA does not have detailed country-by-country data used in these analyses, most of which were completed by other Administration agencies.

c. Complete the anticipated domestic baseline costs, e.g., without any flexibility measures, each analysis identified in your response to question no. 12 assumes will be necessary for each country from 2008 to 2012 identified in **Chart C** to meet its Kyoto Protocol obligations.

A12c. The set of economic and other kinds of analyses undertaken by the Administration predating the 1997 Kyoto Conference is large. CEA does not have detailed country-by-country data used in these analyses, most of which were completed by other Administration agencies.

13. Identify and produce all Administration analyses, either economic or otherwise prior to December 10, 1997 that demonstrates the effect on U.S. jobs of reducing greenhouse gas emissions to 1990 levels.

A13. A set of documents pertaining to this request is being provided to the Committee. Additional documents responsive to this request reflect internal deliberations of the Executive Office of the President with regard to ongoing policies of the Administration and have not been produced.

14. Identify and produce all Administration analyses, either economic or otherwise, after December 10, 1997 that demonstrates the effect on U.S. job of reducing greenhouse gas emissions to 1990 levels.

A14. We are not familiar with any Administration analyses that evaluated an emissions target of 1990 levels after December 10, 1997, with one exception in the set of scenarios evaluated in conducting the AEA (please refer to answer 8). This one exception did not include an assessment of employment implications.

15. Identify and produce all Administration analyses, either economic or otherwise, prior to December 10, 1997 that demonstrates the effect on U.S. jobs of reducing greenhouse gas emissions to 7% below 1990 levels.

A15. We are not familiar with any Administration analyses that evaluated an emissions target of 1990 –7% levels prior to December 10, 1997, however, analyses were conducted on a range of targets that includes this emissions level. A set of documents pertaining to this request is being provided to the Committee. Additional documents responsive to this request reflect internal deliberations of the Executive Office of the President with regard to ongoing policies of the Administration and have not been produced.

16. Identify and produce all Administration analyses, either economic or otherwise, after December 10, 1997 that demonstrates the effect on U.S. jobs of reducing greenhouse gas emissions to 7% below 1990 levels.

A16. The AEA includes a discussion of the possible impacts of the Kyoto Protocol on employment. Please refer to page 62 of the AEA for this discussion.

17. Identify and produce all Administration analyses, either economic or otherwise, prior to December 10, 1997 that demonstrates the effect on U.S. jobs of reducing greenhouse gases any amount.

A17. A set of documents pertaining to this request is being provided to the Committee. Additional documents responsive to this request reflect internal deliberations of the

Executive Office of the President with regard to ongoing policies of the Administration and have not been produced.

18. Identify and produce all Administration analyses, either economic or otherwise, after December 10, 1997 that demonstrates the effect on U.S. jobs of reducing greenhouse gases any amount.

A18. The AEA includes a discussion of the possible impacts of the Kyoto Protocol on employment. Please refer to page 62 of the AEA for this discussion.

19. Complete the anticipated amount of greenhouse gas emissions and reduction obligation the Kyoto Protocol assumes for each country from 2008 to 2012 identified in **Chart A**.

A19. Please refer to answer 1a.

a. Complete the anticipated amount of credits the Kyoto Protocol assumes each country from 2008 to 2012 identified in **Chart B** will supply or demand.

A19a. Please refer to answer 1b.

b. Complete the anticipated domestic baseline costs, e.g., without any flexibility measures, the Kyoto Protocol assumes will be necessary for each country from 2008 to 2012 identified in **Chart C** to meet its Kyoto Protocol obligations.

A19b. Please refer to answer 1c.

20. At the April 29, 1999 hearing, you testified some analyses conclude that the permit price for a ton of carbon dioxide will be less than $14 to $23 per ton. Identify, by author, date of analyses, location of analysis, and produce all analyses, which conclude that the permit price for a ton of carbon dioxide is less than the Administration's $14 to $23 per ton.

A20. The statement regarding the results of other modeling analyses referred to the research of modeling teams participating in the Stanford Energy Modeling (EMF) forum. The findings from this exercise were published in a special issue of The Energy Journal this spring. For an overview and comparison of the modeling results, we suggest that you review the following paper:

> Weyant, J.P. and J.N. Hill. 1999. Introduction and Overview. *The Energy Journal*, Kyoto Special Issue: vii-xliv.

A paper copy of this article is enclosed. Page xxxi provides a chart detailing carbon price comparisons of the 11 EMF models that had results for the United States. This chart includes results from models with permit prices greater than those estimated by the Second Generation Model used by Pacific Northwest National Laboratory and results from models with permit prices lower than those estimated by SGM. For more detail on these modeling results – including authors, affiliations, and date of research publication -- we provide the citations for the published articles on EMF models below:

> Bernstein, P.M., W.D. Montgomery, T.F. Rutherford, and G. Yang. 1999. Effects of Restrictions on International Permit Trading: The MS-MRT Model. *The Energy Journal*, Kyoto Special Issue: 221-256.
>
> Bollen, J., A. Gielen, and H. Timmer. 1999. Clubs, Ceilings, and CDM: Macroeconomics of Compliance with the Kyoto Protocol. *The Energy Journal*, Kyoto Special Issue: 177-206.
>
> Cooper, A., S. Livermore, V. Rossi, A. Wilson, and J. Walker. 1999. The Economic Implications of Reducing Carbon Emissions: A Cross-Country Quantitative Investigation using the Oxford Global Macroeconomic and Energy Model. *The Energy Journal*, Kyoto Special Issue: 335-366.
>
> Jacoby, H.D. and I.S. Wing. 1999. Adjustment Time, Capital Malleability, and Policy Cost. *The Energy Journal*, Kyoto Special Issue: 73-92.
>
> Kainuma, M., Y. Matsuoka, and T. Morita. 1999. Analysis of Post-Kyoto Scenarios: The Asian-Pacific Integrated Model. *The Energy Journal*, Kyoto Special Issue: 207-220.
>
> Kurosawa, A., H. Yagita, Z. Weisheng, K. Tokimatsu, and Y. Yanagisawa. 1999. Analysis of Carbon Emission Stabilization Targets and Adaptation by Integrated Assessment Model. *The Energy Journal*, Kyoto Special Issue: 157-176.
>
> MacCracken, C.N., J.A. Edmonds, S.H. Kim, and R.D. Sands. 1999. The Economics of the Kyoto Protocol. *The Energy Journal*, Kyoto Special Issue: 25-72.
>
> Manne, A.S. and R. Richels. 1999. The Kyoto Protocol: A Cost-Effective Strategy for Meeting Environmental Objectives? *The Energy Journal*, Kyoto Special Issue: 1-24.
>
> McKibbin, W., M. Ross, R. Shackleton, P. Wilcoxen. 1999. Emissions Trading, Capital Flows, and the Kyoto Protocol. *The Energy Journal*, Kyoto Special Issue: 287-334.

Nordhaus, W.D. and J.G. Boyer. 1999. Requiem for Kyoto: An Economic Analysis of the Kyoto Protocol. *The Energy Journal*, Kyoto Special Issue: 93-130.

Peck, S.C. and T.J. Teisberg. 1999. CO2 Emissions Control Agreements: Incentives for Regional Participation. *The Energy Journal*, Kyoto Special Issue: 367-390.

Tol, R.S.J. 1999. Kyoto, Efficiency, and Cost-Effectiveness: Applications of FUND. *The Energy Journal*, Kyoto Special Issue: 131-156.

Tulpule, V., S. Brown, J. Lim, C. Polidano, H. Pant, and B. Fisher. 1999. The Kyoto Protocol: An Economic Analysis Using GTEM. *The Energy Journal*, Kyoto Special Issue: 257-286.

21. At the April 29, 1999 hearing, you testified some analyses conclude that the permit price for a ton of carbon dioxide will be more than $14 to $23 per ton. Identify, by author, date of analysis and location of the analysis, and produce all analyses, which conclude the permit price for a ton of carbon dioxide is more than the Administration's $14 to $23 per ton.

A21. Please refer to answer 20.

22. Please produce all documents reviewed when responding to these questions.

A22. Responsive materials not subject to privilege will be made available for the committee's review.

23. The Administration identified the recent energy restructuring bill's effect on various groups and sectors of the nation. Please provide the same information for the Kyoto Protocol, including, but not limited to, the following:

a. the Council of Economic Advisers estimates regarding increased costs for an average household in key regions of the country. This should include estimates for oil (heating and gasoline), natural gas, and electricity for a typical household in the Northeast, Southeast, South, Mid-West, Northwest and Southwest regions of the United States;

A23a. We do not have estimates of the distribution of household impacts by region.

b. the Council of Economic Advisers estimates regarding increased 2010 living costs for a senior citizen living on social security;

A23b. We do not have estimates of the distribution of impacts by age group.

c. the Council of Economic Advisers estimates regarding increased 2010 living costs for an individual living on welfare;

A23c. We do not have estimates of the distribution of impacts by income group.

d. the Council of Economic Advisers estimates regarding operating costs for an average small business of 50 employees. This should include estimates for oil (heating and gasoline), natural gas, and electricity for a typical small business in the Northeast, Southeast, South, Mid-West, Northwest and Southwest regions of the United States.

A23d. We do not have estimates of the distribution of impacts by firm size.

○